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ELECTRIC ENTERPRISE IN NORWAY.

One of the most striking hydroelectric plants which we have yet had the pleasure of recording is the huge Norwegian development which we describe elsewhere in our columns. It is notable not only on account of its extraordinary size, reaching, when the two plants now under construction are complete, 250,000 hp, but also on account of the fact that this development has been almost wholly with the view of furnishing power for the nitrate plants which have come to be a feature of Norwegian industry. The plant from the hydraulic standpoint is somewhat unusual and is besides a typical example of the situation which develops in Norway rather more frequently than elsewhere. Norway is from the hydroelectric standpoint exceptionally well ordered. It is both mountainous and characterized by a heavy rainfall. Its streams are short from the standpoint of the American, at least, not infrequently fed from considerable lake areas in the uplands and presenting heavy falls in a comparatively short distance. In the present case, for example, the River Maane, on which the plants are located, is only 20 miles long, but takes its rise in a lake having a developed surface area of 22 square miles, nearly 3000 ft. above sea level. It thus becomes possible to utilize a large head within a comparatively short length of river, and to obtain an exceptionally uniform flow, the drainage area of the upper lake in this case being 570 square miles.

As a matter of convenience, owing to the topographical situation, the whole power is to be developed in two sections aggregating a quarter of a million horse-power. In the electric plant there are no sensational developments save the extraordinary size of the impulse turbines, which rise to 14,500 hp apiece. Transmission distances being very short, 11,000-volt generators are used directly upon the line. It is the utilization of the power from this great plant that presents to the American engineer the greatest interest and novelty. This power is to be employed by the Rjukan saltpeter works for the production of saltpeter from atmospheric nitrogen. If we remember correctly, some of the earliest, if not the very earliest, work on the fixation of atmospheric nitrogen was done in this country, but the industry has not prospered here and it has remained for European engineers to reduce the process to a commercial success upon a very large scale. The Norwegian plant in question has for its fundamental object the production of nitrates, chiefly saltpetre, while some of the Continental processes have been directed to the production of pure nitric acid, in each case the source being the nitrogen of the atmosphere. Until within a few years the world's supply of nitrates has been entirely from natural sources of somewhat dubious extent and amount; and, inasmuch as nitric acid is a fundamental in the chemical industry, a synthetic source of supply is to be considered as ultimately of enormous importance. Fancy, for instance, what would have been the effect if 10 years ago the world's nitrate supply had given out or had been cornered in the hands of a single aggressive nation. Practically all explosives have to be derived directly or indirectly from nitrates, and the giving out

of the precious supply might have reduced the civilized nations to battling again with spear and bow. There are those, of course, who would have rejoiced temporarily in the absence of "villainous saltpeter," yet the ultimate results upon civilization might have been disastrous in the extreme.

This and other perils have been successfully avoided by the highly successful electrochemical methods of obtaining an adequate supply of nitrates from the nitrogen of the air. One might even pass forward in a speculative way to the consideration of thus keeping the balance of the composition of the atmosphere somewhat nearly in its normal place. Most of the huge natural chemical processes involve the oxygen of the atmosphere, and artificial means of rounding up the nitrogen and making it furnish its share of the world's supplies may be considered of ultimate benefit in preserving the nice balance of Nature. Be that as it may, the artificial nitrates industry is of great importance to the world, first, in that it provides a practically inexhaustible supply of material which might otherwise rise seriously in price; and second, because industries of this character give a beautiful opportunity for utilizing surplus water-power. If one considers the total available water-power of a given watershed, it is then clear that natural conditions usually permit of only very imperfect utilization. The huge run-off at certain times of the year is practically lost, and even aside from this, most plants have from the nature of their market supply a very irregular load factor. If the surplus energy now running to waste in many plants could be transmitted and utilized for nitrate works, there would be opportunity for working the available powers to very much greater advantage than now. With a reliable customer for surplus power of this kind it would probably become possible to reduce the price of transmitted power for manufacturing purposes to the point that would take in new lines of industry. It is this feature of the matter that ought to be investigated by those who are interested in hydroelectric developments.

Characteristics of Single-Phase Induction Motors.

The characteristics of the single-phase induction motor equipped with a commutator furnish the most instructive study possible of the many types of electric motors that have been developed for industrial service. This machine exhibits certain of the characteristics of the direct-current motor, the polyphase induction motor, the single-phase induction motor, the so-called repulsion motor and other motors of the alternating-current commutator type. It will be appreciated at once that a complete understanding of the inter-relations between the electromotive forces, currents, magnetomotive forces and fluxes in a motor possessing the characteristics of the one here mentioned cannot be obtained from a superficial investigation, but considerable study is necessary in acquiring the desired information. An analytical treatment of this machine, which can be studied with the minimum of unnecessary exertion, is given in an article by Mr. Val. A. Fynn, the first part of which appears in this issue. This article deals with actual conditions at no-load and under-load of those types of machine of which the ideal no-load conditions were discussed in an article by the same author which appeared in our issues for Nov. 18 and 25.

In the installment in this issue the author deals more particularly with the no-load conditions of a motor of the type having a commutator short-circuited in line with, and in electrical space-quadrature with, the primary magnetism. This machine is equivalent in operating features to the machine commonly known as the single-phase induction motor. The magnetic field in this motor possesses two components, one in line with the primary coil, which is practically constant at all speeds, and another almost in electrical-space quadrature therewith, which varies directly with the rotor speed. The current which produces the latter field varies directly therewith, but it occupies such an electrical-space position along the rotor as not to react directly upon the primary magnetism. The current in the rotor which does react upon the primary magnetism is produced by an e.m.f. which is the vector difference between the e.m.f. that would be produced by the transformer action of the primary field if it existed alone and the e.m.f. due to the speed action of the magnetism in quadrature therewith. To the extent that the former e.m.f. may be considered constant, the latter varies with the product of the speed and the quadrature magnetism—that is, with the square of the speed. Even at synchronous speed, when the two e.m.fs. may be considered as equal in value, their vector difference is not zero, because they are not in direct time-phase opposition. The relative numerical and time-phase relations here outlined are well discussed in the articles by Mr. Fynn.

The Absolute Measurement of Resistance.

The absolute measurement of resistance is only of secondary interest to the electrical engineer, because he relies upon some national laboratory for the maintenance of his standards, and, as long as his resistances agree with those of everyone else to one part in ten thousand, when great care is required, he is not directly concerned with the question. The subject is, nevertheless, of primary interest to the national laboratories, where the electrical engineering standards are safeguarded and maintained. Up to the present time it has been necessary to make up primary standard ohms in pure mercury, using carefully calibrated glass tubes for the purpose, and verifying the resistance of these mercury standards occasionally by absolute electromagnetic measurements. One of the most satisfactory methods for such measurements is the Lorenz method, which employs a very small dynamo without iron cores, for producing a determined e.m.f. at a carefully measured speed. The armature of this dynamo is a simple rotating copper disk, from the axis and periphery of which the measured e.m.f. is derived. Even at fairly high speeds, however, this little homopolar dynamo delivers but a feeble e.m.f., usually only a small fraction of a volt; whereas a higher degree of precision might be obtainable if the e.m.f. available were a volt or more.

An innovation into this method has been lately proposed by Dr. E. B. Rosa, in the *Bulletin* of the Bureau of Standards. The plan is to use a wound armature, instead of a disk, in the standard dynamo. The wound armature will be two-phase in type, and each of the two phases will be led, through a two-part commutator, to one coil of a three-coil differential galvanometer. By rotating the two-phase armature at 25 turns per second, in a magnetic field produced by a pair of fixed enveloping air-coils, an e.m.f. of several volts may be expected. Another innovation suggested in the article is the measurement of the magnetic flux linked with the rotating armature coils by direct comparison with mutual inductance standards. The ordinary Lorenz method is to compute the inductance from the

dimensions of the field coils and of the disk armature. If it is found practical and reliable to use commutators in the armature circuits of this interesting instrument, great advantage may be hoped for from its use. Hitherto, no one has dared to use a commutator in any such absolute measurements. It is pointed out that it should be possible to standardize wire resistances directly in absolute measure against an absolute resistance machine, and so dispense with the troublesome intermediate mercury ohm. It will be interesting to learn whether such a result can be attained with the new device when completed.

UTILIZING CHICAGO'S WATER-POWER.

It is gratifying to note that a movement is now on foot in Chicago on the part of the authorities which bids fair to give Chicago the full municipal benefit of its valuable Drainage Canal water-power, which has heretofore to some extent gone to waste for lack of utilization on the part of that city. Chicago much needs an extension of electric street lighting to cover the entire city. As we understand it, the amount of water-power available as an immediate result of the building of the Drainage Canal is approximately sufficient to light electrically a large portion of the streets of Chicago. The city of Chicago has lacked funds with which to build the distributing system necessary for utilizing the power which the drainage board has offered at a very low figure. A scheme of financing has now been proposed whereby the sanitary district assumes part of this burden. President McCormick, of the sanitary district trustees, also urges the use of water-power during the daytime for the pumping of city water, as a means of saving fuel at the least efficient pumping stations. This utilization of power which has been created by the money of the taxpayers of Chicago is much more logical than a plan of distributing power and light for miscellaneous commercial purposes at a low-load factor. It is along the lines that we have previously urged as being most logical from an economic standpoint, and the most likely to save the money of the taxpayers of Chicago.

ELECTRIC IGNITION.

At a recent meeting of the Manchester Section of the British Institution of Electrical Engineers a paper was read by Mr. J. W. Warr on the subject of electric ignition in relation to internal combustion engines. Electric ignition systems may broadly be divided into two classes, namely, low-tension and high-tension systems. In low-tension systems a circuit containing a low or moderate voltage and an inductance is broken within the cylinder in the presence of the gases to be ignited, the spark at rupture producing the ignition. In high-tension systems, a jump-spark is produced between fixed electrodes in the cylinder across a definite gas-gap. This calls for a fairly high tension, produced either by a magneto-dynamo, or by a Ruhmkorff cell. The advantage of the low-tension method is that the apparatus used may be of a very simple type, consisting, say, only of a few dry cells, a simple inductance coil and mechanically operated contacts, or spark-plugs. The advantage of the high-tension method is the elimination of the friction and wear of the break-contact mechanisms within the cylinders. Various modern details of structure and arrangement are described in the paper with reference to both systems of ignition. It is evident that although both systems are used very largely in automobile practice there remains considerable room for improvement in electric ignition.

MEASUREMENT OF HIGH PRESSURES BY CHANGES OF RESISTIVITY IN CONDUCTORS.

As mentioned in the Digest, a paper has recently been communicated to the French Academy of Sciences by M. A. Lafay, which deals with the changes in resistivity observed in certain solid and liquid conducting prisms under heavy pressures per unit area. Such measurements have been made by various experimenters on manganin, platinum, mercury, aqueous solution of zinc-sulphate and other bodies. The remarkable fact noticeable in all these measurements is the relatively small amount of the change in resistivity at constant temperature that the pressure is able to effect. The prevalent theory of electric conduction in material conductors is that the molecules form a sort of bucket brigade in which bucketfuls of electricity, or ionic charges, are passed on from hand to hand—that is, from one molecule to the next. On this hypothesis, one would naturally suppose that when the brigade was subjected to pressure, thereby bringing the individuals nearer together, the conductive process would be facilitated and accelerated to a marked degree. In general, it is facilitated—that is to say, the resistivity is reduced, but ordinarily only to a very minute degree. For instance, some data for platinum given in the above-mentioned paper show a reduction of less than 2 per million in the resistivity per atmosphere of applied pressure. In liquid mercury, the change is somewhat greater, being 33 per million per atmosphere. It is evident that we have yet a great deal to learn concerning the constitution of matter before we can understand the nature of such resistivity changes.

CRYSTAL AND SOLID-CONTACT RECTIFIERS.

In the operation of wireless telegraphy, crystal receivers have now been used for several years with considerable success. The receiver consists essentially of a conducting crystal on which rests a metallic point, the pair being connected with the receiving aerial in such a manner that the high-frequency electric currents pass through the contact between crystal and point. This contact is also shunted by a delicate telephone receiver. The high-frequency currents are unable to pass through the impedance of the telephone, but these currents are partly rectified at the contact, so that the rectified currents pass without difficulty through the telephone and produce audible signals. A large number of crystals have been found to possess the above remarkable property of rectification in appreciable degree. Notable among them for effectiveness in this particular are crystals of silicon, perikon and molybdenite. In order to be effective, the conductivity of the crystal has to be fairly large in the favored direction. That is, crystals which are essentially non-conductors are of no use, however great their rectification might be of infinitesimal currents. Strangely enough, it has been found very difficult to explain the rectifying action, which seems in some manner to be associated with the crystalline structure, although a few amorphous substances are stated to possess the property in feeble degree. A recent article by Mr. Alan E. Flowers, in the *Physical Review*, discusses some experimental observations on crystalline rectifiers, and reaches the conclusion that the rectification is probably due to the electrochemical formation of a high-resistance film at each alternate reversal of current. If this view is correct, a crystal rectifier bears close analogy to an electrolytic rectifier with aluminum plates immersed in a suitable electrolyte. The subject is, however, still in a highly debatable state.

New York City Adopts National Electrical Code.

Commissioner John H. O'Brien, of the Department of Water Supply, Gas & Electricity of New York City, has announced the withdrawal of the interior wiring rules of the city, comprising Classes *A* and *C* of the rules and regulations published by the department, and the substitution therefor of the interior wiring rules of the 1909 edition of the National Electrical Code as included in Class *A*, stations and dynamo rooms, and Class *C*, inside work, with such modifications (noted below) as are rendered necessary by local conditions and ordinances.

All of the rules relating to concealed knob and tube work are expunged, since this class of wiring has not been permitted in New York City for many years. The third paragraph of Rule No. 8-*c*, relating to overload release devices and motor-starting rheostats, is omitted, so that these devices under no circumstances can be considered as substitutes for cut-outs in New York. Rule No. 15-*b* has been modified so as to bring out the intention of the rule, that tie wires should have an insulation of the same type as that of the conductors they confine, and must be of such size as to afford ample mechanical security. If interpreted as printed in the new edition of the code, a 5000 circ.-mil cable, for instance, would require a 5000 circ.-mil cable as a tie wire, since the insulation of wires is graded in thickness to the size of the wire, and a wire smaller than 5000 circ. mil would not have equal insulation.

Rules Nos. 21-*a* and 22-*a*, relating to the position of cut-outs and switches on service wires, are open to modification by special permission in writing given in advance, there being so much vault space in New York City that the intention of the rule is best served by certain permissible breaches. Rule No. 21-*d*, relating to link fuses, is omitted from the list of wiring regulations, since the present ordinances do not permit this construction.

Rule No. 24-*g*, calling for wires with approved rubber, slow-burning, weatherproof or slow-burning insulation for open work in dry places, has been slightly amended by requiring special permission in writing in advance for wires with slow-burning insulation, the Commissioner doubtless feeling that to specify the best wire and then add that the cheapest wire will do is hardly logical. The third paragraph in Rule No. 24-*h*, which in the revised code reads, "the neutral of an Edison three-wire system may be placed in the center of a three-wire cleat where the difference of potential between the outside wires is not over 300 volts, provided the outside wires are separated 2½ in.," is omitted from the New York City rules, since there are other three-wire systems besides the Edison, and the present rule would infer that the neutral of an alternating-current, three-wire system could not be so placed.

Rules Nos. 24-*A*-*b* and 25-*d*, calling for an outlet box or plate at every outlet, have been slightly modified by the addition of the words "or other approved device," so as to conform with the present rules of the department and present practice in New York.

Rule No. 25-*b*, calling for continuous conduit from outlet to outlet or to junction boxes, which in case of service connections in main runs involves running each conduit continuously into a main cut-out cabinet or gutter surrounding the panel board, as the case may be, has a proviso added that a departure may be authorized under special permission in writing given in advance, so as to conform with the present practice in New York City. Rule No. 25-*A*-*b*, relating to the passage of metal moldings through floors, has been slightly changed by the omission of the first clause in the second paragraph, so that where metal molding has the necessary mechanical strength the modification mentioned in the paragraph is permitted.

Rule No. 27-*b*, relating to sockets in damp or wet places, has been modified by the substitution of the word "weatherproof" for "waterproof," and the proviso that the sockets shall be especially approved for the location. The reason for this is that the approved list of fittings does not mention waterproof but weatherproof sockets, and there are virtually two classes of these, so that while a certain type of weatherproof socket would be approved for an electric sign, an entirely different type might be applicable for a damp cellar, the socket in the first instance being designed to resist driving rains, which do not necessarily occur in the latter location.

Rule No. 31-*A*, relating to theater wiring, has been broadened by omitting from the general note the words "which is capable of seating at least 400 persons." A theater in New York City may seat a lesser number of persons, and the Commissioner feels that especial vigilance should be exercised in protecting patrons of moving-picture shows, many of which are in reality small theaters which do not seat the number of persons specified in the rules governing theater wiring. The notes at the bottom of Rule No. 31-*A*-*a*, relating to theater wiring, stating that the rule solely concerns the protection of the person, and should therefore be left to the discretion of the assured so far as the fire risk is concerned, has been stricken from the city regulations. A note stating that the number of services specified, source of supply, etc., may be modified by special permission in writing given in advance, is added.

Rule No. 31-*B*-*i*, relating to sockets and receptacles for outline work, has been slightly modified to conform with practice in New York City, by stating that only such wires as are connected to open terminal receptacles, and not enclosed in outlet boxes, shall be soldered to lugs on the sockets and receptacles. Rule No. 36-*c*, relating to the installation of transformers, has been modified so that transformers inside buildings must be permanently and effectually grounded in New York City.

The Commissioner has taken no action on rules relating to marine wiring, since these are outside his jurisdiction and rest with the Federal authorities. The rules relating to outside work, being so modified by ordinances, etc., in New York City, no immediate action on these will be taken until the men at present engaged in an attempt to harmonize the city rules and regulations with the requirements of the National Electrical Code have reported their recommendations.

New York Public Service Commission Rules for Testing Electric Meters.

The New York City Public Service Commission has issued in printed forms its rules and regulations relative to testing electric meters, which went into effect on Nov. 1. Forms are included for reports on complaint, periodic and office tests of meters. The first-mentioned is defined as a test made by an electrical corporation upon the premises where the meter is installed as the result of a complaint of the customer. A periodic meter test is a test made by an electrical corporation in the regular course of its business upon the premises where the meter is installed, but not at the time of installation, which test is not made as the result of a complaint from the consumer nor by direction of the corporation, of an officer or of an employee that a special test be made. An office meter test is a test made by an electrical corporation, upon the premises where the meter is installed, by direction of the corporation itself, of an officer or of an employee that a special test be made.

The rules require that every electrical corporation operating within the First District shall file with the Public Service Commission monthly reports, in the form prescribed, stating the results of all tests of electric meters tested for accuracy during that month. Such reports shall be made for the calendar month and shall be filed not later than the fifteenth of the following month.

All tests are required to be made with the meter in its permanent position on the consumer's premises and under actual operating conditions as regards voltage, frequency, temperature, stray fields and vibration.

Where shunts, series transformers or shunt transformers are used in connection with a meter, the meter shall be tested from the line side of such apparatus when the voltage

does not exceed 600 volts. In periodic tests where the line voltage exceeds 600 volts, the meter may be tested as a self-contained meter, and the ratio certificates of the transformers may be used in calculating the true line watts, provided said certificates are dated within the five years preceding the time the meter is tested. In complaint and office tests, the commission will accept the ratio certificates of the transformers, provided they are dated within the year preceding the time the meter is tested. When rotating standard meters are used, the connections must be so arranged as to give the tester full control of the starting and stopping of the standard and at the same time allow him to count the revolutions of the meter under test.

Each meter shall be tested independently, and no meter shall be tested while connected in series with one or more other meters unless the potential circuit of each meter is so arranged as not to be fed through the field of any meter under test or rotating standard. All indicating and integrating instruments used as standard instruments in testing meters shall be equipped with scales properly proportioned to the loads measured.

All meters shall be adjusted so as to register with an error of not more than 1 per cent at light load and at full load, and both of these adjustments shall be maintained in this condition as nearly as possible. All meters, whenever possible, shall be tested at three loads: one-tenth of the full rated capacity of the meter, normal load, and full rated capacity of the meter. The average of these tests, obtained by multiplying the result of the test at normal load by three, adding the result of the tests at one-tenth capacity and full capacity and dividing the total by five, shall be deemed the condition of the meter, and such final average shall be reported to the commission on the form prescribed by it. In an installation where it is impossible to obtain a load of 10 per cent of the rated capacity or 100 per cent of the rated capacity of the meter, tests shall be made at the nearest obtainable loads to 10 per cent and 100 per cent of rated capacity of the meter and values given in the ratios.

The following classification, in percentage of installation, shall be used in determining normal test load:

A.	Residence and apartment lighting	25%
B.	Elevator service	40%
C.	Factories (individual drive), churches and offices	45%
D.	Factories (shaft drive), theaters, clubs, entrances, hallways and general store lighting	60%
E.	Saloons, restaurants, pumps, air compressors, ice machines and moving picture theaters	70%
F.	Sign and window lighting and blowers	100%

When a meter is found to be connected to an installation consisting of two or more of the above classes of loads, the normal load used must be obtained by taking the average of the percentages for the classes so connected. Three tests shall be made at each load at which the meter is tested, but should any two fail to agree within 1 per cent, additional tests shall be made until three results are obtained which do not vary one from another more than 1 per cent.

Decision Under Recent German-American Patent Agreement.

Patent Commissioner Moore in commenting on the German decision reported in these columns last week whereby American patentees are awarded valuable privileges in Germany, said that the decision is of far-reaching importance and means millions of dollars to American manufacturers. "The real effect of the decision," said Mr. Moore, "will be to prevent non-forfeiture of 'live' patents granted by Germany to American citizens, both before and subsequent to the treaty of 1908. This instrument, negotiated by the Commissioner, provides that American inventors and manufacturers owning German patents no longer should be required to manufacture their products in Germany, which they had been required to do and which involved a large outlay and a duplication of plants."

Mr. Moore went to Europe this year at the request of the State Department and negotiated with Denmark, Norway, Sweden, Russia, Austria, Italy, Spain, France and Belgium treaties similar to that with Germany.

New Chicago Street-Lighting Proposition.

In a letter dated Nov. 29, Mr. R. R. McCormick, president of the board of trustees of the Sanitary District, Chicago, makes an interesting offer by which he says the street-lighting facilities of the city may be increased without expense to the latter. The letter is addressed to Alderman B. W. Snow, chairman of the finance committee of the City Council. In it Mr. McCormick remarks that the water-power of the Sanitary District belongs to the people, and that the best public use to which it can be put is in lighting the streets of Chicago. The city of Chicago is without funds to extend its lighting system; the finances of the Sanitary District are in good condition; therefore, the resources of the District should be used to provide street lighting in so far as such use will not interfere with the acomplishment of the primary purpose of the Sanitary District, which is sanitation.

Mr. McCormick points out that the transmission lines of the Sanitary District and of the municipal plants of Chicago often parallel each other, and that as both are owned by municipal bodies, this duplication is unnecessary, and by doing away with it, in existing lines and in planning for the future, much unnecessary expense may be avoided. For instance, as it is now, the city and the Sanitary District each has a substation on Fullerton Avenue, not a mile apart. The city has a transmission line here and the Sanitary District has two. On Thirty-fifth Street, from Western Avenue to Ashland Avenue, there are two transmission lines on one set of poles belonging to the city; in addition there is one Sanitary District overhead transmission line and another belonging to the same owner carried underground. In this case there is an unnecessary expense approximating 50 per cent of the total cost of the construction. Lincoln Park is lighted by the electricity supplied by the Sanitary District, and in order to reach it the transmission circuits pursue a circuitous route. "There are cases," says Mr. McCormick, "where in its commercial business the Sanitary District is operating distribution lines as much as a mile long to supply customers next door to some city station. The Bloomingdale Road line of the Sanitary District runs directly past the Springfield Avenue power station of the city."

Mr. McCormick says that if no better plan can be agreed upon he will acquiesce in the proposition that the Sanitary District finance the equipment of street-lighting circuits in parts of Chicago where there is no electric street-lighting now. But he prefers an alternative proposition which he makes in the following terms: "Let the Sanitary District purchase from the city of Chicago for cash the 12,000-volt transmission lines necessary to bring the current to the city's substation. Let the Sanitary District purchase the substations and electrical equipment therein and contract to supply the current to the city circuits at the present price, plus an agreed charge to cover the cost of transmission and delivery of current upon the arc systems of the city. I will guarantee that from such an arrangement the city will be given current on its arc circuits at a price less than the present cost. The money paid by the Sanitary District to the city for these transmission lines and substations can then be expended by the city in enlarging and increasing the number of its present arc circuits. This plan will provide the needed lights, will lessen the cost of current to the city and will provide for the Sanitary District transmission lines and substations which are needed for the sale of its surplus current."

The president of the Sanitary District board thinks that the city should begin the work of installing electric motors in its water-works pumping stations. To a large extent, the pumping of water is done at night, and the same generating equipment could be used to supply electricity for pumping water in the daytime and lighting the streets at night. The fact that the city is paying $15 a hp-year for electricity for lighting and could obtain electricity on a 24-hour basis for $26.40 a hp-year should make the proposition attractive, Mr. McCormick thinks. The demand for electrical energy for pumping and for street

lighting will coincide to some extent, but at these periods the steam-pumping engines held in reserve could be used to supplement the electric motors. The writer thinks that the electric pumps should be introduced gradually, replacing at first the oldest and least efficient steam-pumping units. Sufficient steam equipment should be preserved for emergency purposes. Mr. McCormick concludes his letter as follows:

"Aside from whatever profits may be derived from the sale of power, I have no hesitation in saying that a comprehensive use of the water-power of the Sanitary District for public purposes by all the governmental bodies in Cook County will result in an economy of not less than $1,000,000 a year."

Whether the City Council will agree to sell the city's transmission lines and substations to the Sanitary District is unknown, of course, but is perhaps doubtful. The Sanitary District has now about 10,000 hp connected load in commercial power business, supplying alternating current to customers at 60 cycles. This business is reported to be on a satisfactory financial basis. In relation to possible interruptions of service, the Sanitary District officials point out that the records show that the proportion of uninterrupted service to perfectly continuous service is from 98 to 99 per cent. They say that the service of supplying electricity has never been interrupted for more than 10 minutes at a time, unless the telephone service has been broken down also. There are two 30-mile three-wire transmission circuits between the generating station on the Drainage Canal at Lockport and the Western Avenue terminal station in Chicago. If telephone communication can be had between the power house and the terminal station, only a very extraordinary storm would prevent a selection of three wires out of the six by which electricity could be transmitted in proper phase while repairs were being made to the damaged wires. But when the telephone line has gone down, too, owing to sleet troubles, for instance, there is obviously greater delay. To provide a remedy for this state of affairs, the Sanitary District is now putting in an underground telephone line between the Lockport power station and the Western Avenue terminal station, at a cost of about $20,000. This will be a duplicate private line in underground cables, and it should afford uninterrupted communication between the two termini of the transmission line.

President Van Hise on Water-Power.

The importance of reservoirs being erected at the headwaters of streams available for water-power was emphasized by President Van Hise, of the University of Wisconsin, in a recent lecture on the conservation of natural resources. He said that to maintain a uniform flow in streams, the most pressing and necessary need, in addition to forests, is the construction and maintenance of such reservoirs. It was shown that although this work will take a great amount of money, the value of the water-power furnished by them will alone make it profitable. Some work of this kind has been done in Wisconsin by two large water-power companies, which have constructed reservoirs on the Wisconsin River. President Van Hise estimated that about 2,000,000,000 cu. ft. of water are held behind these dams, the largest of which are located at Kilbourn, Grand Rapids and Wausau.

In speaking of the control of water-power, President Van Hise said that it should be controlled entirely by the public to prevent unreasonable charges for power and to keep its control from becoming a monopoly. He stated that the concentration of water-power and the coupling up of dams by companies conserve the power resources, and should be encouraged, but to protect the people the companies should be controlled by them. He declared a franchise tax to be equable and just. Another policy brought out was that of having a careful survey made of the streams, so that water-power sites can be selected with a view of developing the full available power. The inspection and approval of all dams by a State engineer to prevent disasters by their breaking was also recommended.

Brailey Telephone Situation.

A hearing in the case of Samuel J. Schweer against the Cuyahoga and United States Telephone companies and others, involving the recent Brailey telephone deal, and held at Cleveland the latter part of last week, developed nothing for the minority stockholders whose protection is sought by the action. Attorneys for the plaintiff said they had hoped to force the Brailey interests to divulge the names of the men who are connected with the purchase of the controlling interest in these companies, but they did not succeed. The other side won in its fight to prevent witnesses from answering questions. Mr. F. H. Goff, president of the Cleveland Trust Company, on advice of his attorney, even refused to give his name.

The hearing was for the purpose of taking depositions and was conducted by Notary C. W. Chestnutt. Attorneys Brown and Morley argued that demurrers had been filed to the petition which seeks to prevent the Independent companies from combining with the Bell interests and that there is no occasion for evidence being taken before a notary. He stated that it could all be brought out at the trial of the case. Mr. James S. Brailey, Jr., and several other witnesses were not present and Attorney Brown stated that they do not intend to come and that they cannot be compelled to do so.

Messrs. E. W. Moore, J. B. Hoge, F. H. Goff and some of the other witnesses were served with subpœnas to appear in a deposition hearing in a similar case filed in St. Louis to be held before Notary R. R. Alexander. Mr. Goff was sworn, but the others refused to take the oath. Mr. Goff stated that he was ready to testify as soon as required to do so by the notary, but that he was acting upon the advice of his attorneys in refusing until that requirement is made. This argument was continued on Saturday without material results of any kind. Attorney S. H. Folles, representing the American Telephone & Telegraph Company, did the greater part of the talking.

Attorneys for the Toledo Home Telephone Company, Toledo, Ohio, have withdrawn their petition in error from the Circuit Court and an entry has been made permitting Herman C. Stifel, of St. Louis, to make an inspection of the books. This action cannot be explained, as all the interested parties have chosen to remain silent regarding it. The inspection will probably be made this week.

On Wednesday of last week Mr. James S. Brailey, Jr., held a conference with a number of prominent Independent telephone men at the Neil House, Columbus, and it has been widely reported that he proposed a compromise by which the Bell companies would withdraw from the local business in all Ohio towns, with the exception of Cincinnati, on condition that its long-distance lines be used exclusively. This would be accomplished, of course, by the purchase of the Bell exchanges by Independents and the sale of the Independent long-distance lines to the Bell people. Cincinnati has always given its business exclusively to the Bell company, so it would probably continue to serve that city in the event that the supposed proposition was accepted. Mr. Brailey would not affirm or deny the truth of this matter after the meeting, but it is reported that a meeting will be held in Cincinnati this week at which the basis of such an exchange will be discussed. Nothing was said at the Columbus meeting regarding a plan for arriving at the value of the various properties, the only point apparently being as to whether the Independents would accept the proposition.

A report has since been sent out from Toledo to the effect that Mr. Brailey has flatly denied that he made a proposition to divide the business, as reported from Columbus. The only ground for such a report, he is said to have stated, is that the United States Telephone Company has said to the managers of the smaller exchanges in the State that there would be no objection to their connecting with the Bell long-distance lines. He said that the Federal Court had rendered a decision to the effect that the company could not prevent this and that this decision forms the basis for the permission which is offered to the small companies. Those companies which have purchased

Bell exchanges in the smaller towns and established toll connections, he said, are working out their own plans and his companies have nothing to do with it.

The Independent men present at the Columbus conference are as follows: Messrs. H. A. Marting, Ironton; G. P. Thorpe, Wilmington; H. P. Folsom, Circleville; James McKell, Chillicothe; O. M. Bake, Hamilton; Frank L. Beam, Mt. Vernon, and W. G. Thompson, Hamilton. Some of these men are members of a committee appointed at a recent meeting to formulate plans for merging the many small companies in Ohio into one large corporation. No idea of the temper of the Independent leaders could be gained from questions put to them following this meeting, but the fact that another has been arranged for Cincinnati would indicate that they are at least considering the matter. The supposition is that a proposition similar to this will be made in all States where the Independents have gained a foothold, but this, of course, is largely conjecture.

It is argued by some that the Independent telephone men, or at least a large majority of them, will be willing to accept the plan said to have been mapped out by Mr. Bailey, as it will put already prosperous exchanges upon a still better basis and bring the laggards into line as money-makers, since competition will be out of the way. As the Bell interests are said to favor the plan of leaving a large part of the stock in the local companies in the hands of local people, the idea of foreign interests dominating the situation will be softened to a considerable extent. The supposition is that, if the Bell people really do secure the control of the long-distance business, the American Telephone & Telegraph Company will acquire about 25 per cent of the stock of each company, or enough to give it some voice in the management. In a way, then, both the local and long-distance business will be under the same control.

In Ohio there is one drawback in bringing about rates for service that will yield a good return upon investments when the business is merged. In most of the towns ordinances have been enacted which prescribe the rates that may be charged for service and, while the companies have won several points in the courts against the cities and towns in this particular, legal complications might result in many places. This was shown when it was thought that steps were being taken a few days ago to restore the old long-distance rates which were cut some months ago, and again when it was said that the Cuyahoga Telephone Company would probably increase its rates for local service. Cleveland Councilmen then brought forth the claim that the company had agreed to furnish service for $36 per year; that the rate had been increased once and that any further increase would meet with determined opposition. Should the systems in Cleveland be combined the one company would then have about 50,000 telephones and it would probably be necessary to have a higher rate than the Cuyahoga's franchise calls for and even a higher figure than they have been charging since the increase was made.

A story was current a few days ago that the Independent companies at Columbus and Dayton had been purchased by a St. Louis syndicate, headed by Herman C. Stifel, instead of by Bell interests as was at first thought. But people have settled down to the belief that this cannot be true and that the story was perhaps started to lead the opposition off the track. On the other hand, it is rumored that F. R. Huntington, who purchased the stock, represents the same interests as James S. Brailey, Jr., does in the purchase of the Cuyahoga and United States Telephone companies.

Among the various theories which have been advanced in Ohio is one to the effect that the Cuyahoga, United States, Columbus Citizens, Toledo Home and Dayton Home Telephone companies will not go to the Bell interests after all, but to a syndicate which will operate them just as they have been in the past, but whose members stand so close to the Bell people that an understanding may be had that will do away with ruinous competition in the future. The Bell interests wish to accomplish this result even more than the Independents and the plan seems feasible in a way. At some future time it has been suggested that a holding company may be formed to take the various plants over and operate them, but for the present there will be no change of any kind, except in actual ownership. According to this theory, no other purchases will be made at this time.

The Profession of Engineering.

President Jesse M. Smith, of the American Society of Mechanical Engineers, in his presidential address before that body on Tuesday, on "The Profession of Engineering," drew a distinction between the trade and profession of engineering. "If," he said, "we are to have a profession of engineering, as distinguished from the trade of engineer, we must have a broad education befitting men of a learned profession, as distinguished from a narrower education sufficient for men of a trade. President Lowell, of Harvard, in his recent remarkable inaugural address, gave this as his conclusion: 'The best type of liberal education in our complex modern world aims at producing men who know a little of everything and *something well.*' If that conclusion be true of a liberal education leading to the learned profession of the law or medicine or theology, why is it not also true of a scientific education leading to the learned profession of engineering? If preponderance be given to one part of President Lowell's conclusion over the other part, certainly knowing 'a little of everything' leads to superficiality; while just as surely knowing but one thing well leads to narrowness. There would seem to be a happy mean between these two extremes, in the education of the engineer. The engineer knowing something of many things, several things well and one thing profoundly, is, however, still one sided if all this knowledge is confined strictly to his profession. He will be a much broader man, and a better engineer, if in his leisure hours he can turn his thoughts entirely away from his professional work and toward those things in nature and art which give that rest and renewal of the professional mind necessary to continued work."

Combination Lighting and Water-Works Plant.

The city of Clovis, N. M., has completed the erection of a combination lighting and water-works plant which has some unique features for a city of only about 6000 population. All secondaries are grounded in accordance with recommendations of the National Electrical Code, excepting the three-phase motor circuits, which will also probably be grounded if it is determined that this is in line with the best engineering practice.

The two 2300-volt, three-phase, 60-cycle generating units for the lighting station are of 100 kw each and direct-connected to single-cylinder engines. The switchboard is equipped with oil switches. The water supply is from four deep wells, each of a capacity of 50 gal. per minute. The pumps are driven by 15-hp motors. An elevated tank of 100,000 gal. capacity is used as a reserve, the head being 140 ft.

The electric ordinance adopted by the city requires all work to be in accordance with the National Electrical Code, which provides for the submission of all plans and specifications for wiring or rewiring, before a permit is issued, and requires the examination of contractors before issuing certificates to do wiring. Among provisions unusual in a town of this size are the elimination of all wooden molding; the use of porcelain sockets or other safety arrangements in order that persons cannot get shocks in basements, livery stables, and other places where there are grounded surfaces; the use of cabinets in all residences, metal cabinets in all mercantile buildings and the placing of all service wires and meter loops in iron conduits, excepting in residences. Suitable penalties are imposed by the ordinance for any violation of its terms.

Peat for Fuel.

In connection with steps now being taken by the Dominion Government toward the active development of the peat industry, it is of interest to refer to an electric lighting plant in operation for the last five years at Skabersjo, Sweden, using peat supplied by a bog of 37 acres. The peat deposit averages 5 ft. in thickness and it is estimated that there is sufficient fuel in this location to last 30 years. There are two gas-engine units of 150 kw each, which are supplied by two Korting suction gas producers. The current is transmitted three miles to Svedala, where it is used for lighting the streets and for furnishing power to several small industries. At present the only by-product is tar, but the experiments now in progress at different places indicate that the sulphate of ammonia and other by-products that may be recovered in a larger station—one of a few thousand horse-power—will be so profitable that they will pay almost all operating expenses.

Lake Tahoe Power Project.

Senator Newlands, of Nevada, has corrected certain inaccuracies in the newspaper account of his recent speech on the question of the proposed contract between the Reclamation Service and a private electric power company (the Truckee General Electric Company, controlled by the Hammon Syndicate) for the storage of water in Lake Tahoe, to be used first by the power company for generating electricity, and later by the Reclamation Service in supplying the settlers on the Truckee-Carson project in Nevada for irrigation. Mr. Newlands says that in addition to the Government Reclamation Service and a private power company there is a third party—the users and consumers of electric energy, whose rights and interests should be considered. He contends that the proposed contract will give a private corporation the monopoly of the electricity generated by the waters of Lake Tahoe and the Truckee River, and says: "If the President should conclude that the best interests of the reclamation project require that the proposed co-operative contract should be approved and the protection of the public against extortionate charges by conditions in the license granted is not within the power or is no concern of the National Government, then it may be necessary for the State of Nevada to organize a Public Service Commission with power to control capitalization and charges."

Large Irrigation and Power Project at Sacramento.

Judge Jas. A. Waymire is working on a project to tap Lake Tahoe for 500,000,000 gal. of water to irrigate the southeastern portion of Sacramento County, Cal. He is quoted in connection with the project as follows: "There are about 300,000 acres in Sacramento County which are now worth little for agriculture, but which, with water brought on, would acquire a value of $100 per acre at once. Legal obstructions have been overcome, and the engineers have traced the route through the mountains down to Auburn, where an immense reservoir will be constructed. The water will be brought from the lake in conduits that will have a carrying capacity of 500,000,000 gal. daily. A large dam will be built near the entrance of Truckee River at the lake. Thence a tunnel five miles long will be cut through the mountains. From the western terminus of the tunnel the north fork of the American will offer a convenient grade to take the water down to the Auburn reservoir. In the course of the canal or conduit to Auburn there will be five falls or drops at which electric power can be generated to the extent of 230,000 hp. These falls will have a height of 900 ft., 400 ft., 1500 ft., 700 ft. and 500 ft., respectively. The capitalization of the company is placed at $50,000,000.

Judge Waymire says that he has engagements with Eastern financiers to take over the bonds necessary and the stock in the corporation.

Electric Club of Chicago.

Business matters were discussed at the meeting of the Electric Club of Chicago on Dec. 1, there being no announced speaker. Reports were received from various committees, and the treasurer, Mr. J. G. Pomeroy, reported a balance on hand of $2,033.80. Mr. F. J. Postel, from the civic committee, presented a resolution expressing the sense of the club that the offer of the trustees of the Sanitary District to provide funds for extending the street lighting of Chicago by the use of electric energy from the Drainage Canal, either by purchasing the city's existing transmission lines and substations or by financing further extensions directly, be approved. This resolution was referred to the board of managers with power to act. Mr. H. F. Holland, from the membership committee, reported a total of 375 members. He moved that an entertainment be held by the club before the annual meeting in February, and this motion was adopted, details being referred to the entertainment committee. The discussion of this motion involved a spirited debate on the general policy of the club, at the conclusion of which, on the motion of Mr. H. E. Niesz, it was voted to restrict the membership to 500. Others who spoke were President F. P. Vose and Messrs. A. L. Millard, J. G. Pomeroy, W. S. Taussig, F. S. Hickok, E. F. Kirkpatrick and H. W. Young. Mr. C. A. S. Howlett, of Schenectady, former president of the club, was present, and by invitation spoke briefly, referring to similar organizations in Philadelphia, Boston and New York.

Tesla on Wireless Electric Power.

Mr. Nikola Tesla in an interview published Dec. 7 in the New York *Press* discussed the subject of wireless transmission of electric power. He said that he has worked persistently on the wireless transmission of energy since 1893, when he presented a paper on that subject before the National Electric Light Association in St. Louis and the Franklin Institute in Philadelphia. The popular idea, he said, is that the wireless system of transmission is just one invention, but the fact is that it involves in its present state of perfection six fundamental discoveries, or inventions, in combination. They are as follows:

First.—The method and apparatus for transforming ordinary currents into electrical oscillations of great intensity.

Second.—The apparatus for intensifying those vibrations immensely, so that they penetrate into the distance.

Third.—A receiving apparatus which collects and focuses energy which a transmitter supplies to a large territory. For instance, if such receiver, properly constructed, be placed in Ireland it will collect practically the entire energy conveyed to that country from the transmitter.

Fourth.—The method and apparatus for making the electrical impulses secret and non-interferable. That is to say, making it impossible to prevent their passage or to read them. The energy of the transmitter, which is collected by the receiver, only can be released by a sort of safety lock or combination.

Fifth.—The production of stationary waves. That is, waves which excite the entire earth and pass through it under a vibration much the same as though you were to draw a string tight and then strike it. With these waves the distance is absolutely eliminated, as the effects are the same whether the receiver is thousands of miles away or close to the transmitter.

Sixth.—A number of inventions which cannot very well be described in a short interview, but which go together to make the system practically operative.

With a plant constructed under the observance of these principles it will, he said, be just as easy to telephone from here to Melbourne, Australia, as across a room, and there will be absolutely no distortion of the voice, such as is observable now in communication by wire. This, he added, is not a theory, but a fact absolutely demonstrated by his experiments, which have shown that the current passes without loss over the entire extent of the globe and through the globe. He has carried the construction of such an installation very far and hopes to be able to complete its construction during the coming summer.

From that moment every telegraphic, telephonic as well as every wireless station will, he said, be ever so much more valuable, as they will be able to receive messages from any part of the world. All this will be done without the slightest change in the existing equipment.

"Will it be necessary under your plan, Mr. Tesla, to build high towers on the shores of the countries using it, and also in interior points?" the inventor was asked.

As to large towers these, he said, are comparatively ineffective. The tower he has built near Port Jefferson, L. I., is only 187 ft. high, but the plant will produce an effect which can be pushed up to a rate of 1,000,000,000 hp, which is more than all the wireless plants that have been put up so far altogether. This enormous activity is secured by the use of certain artifices on which he also bases a confidence that it will be possible to flash signals through interplanetary space.

Mr. Tesla added that his electric power inventions are not altogether his own, and that he has merely laid the foundation. Great work has been done in perfecting the devices by the staff of engineers of the Westinghouse and General Electric companies, so that at present there are hundreds of millions invested in enterprises in which his alternating system forms the underlying foundation. This has harnessed 6,000,000 hp waterfalls.

There are probably enterprises aggregating 20,000,000 more under consideration. The enormous importance of this water power, or the so-called "white coal," can be understood readily when it is borne in mind that 1 hp for 24 hours is equivalent to the average performance of 24 men. Therefore, the 6,000,000 hp which has been harnessed have virtually added to the world's population from the point of view of labor 144,000,000 of workingmen, who consume no food and need no clothes.

As to power other than that derived from waterfalls, he was happy to say that in this direction also he has been successful, having perfected a new reversible gas turbine of ideal simplicity and beauty, which will permit the harnessing of the waste of the steel and iron furnaces, in which we now are losing in the United States not less than 50,000,000 hp. Mr. Tesla added that he is just about to introduce that invention commercially.

As to his wireless system for the transmission of electric power, he said that if it had not been for unfortunate circumstances a plant of this kind would long ago have been in operation. Just one single plant, of, say, 10,000 hp, would be sufficient to drive several thousand flying machines, aeroplanes and dirigibles anywhere in the world. While supplying them with wireless power it also would keep them in constant touch with the earth by wireless telephone and telegraph.

Referring to interplanetary signals, he said he had in his experiments in Colorado discovered certain planetary disturbances, and attained with his transmitter activities which surpassed in power in many ways those of lightning. In his present plant he will be able to reach a rate of energy-delivery of about 1,000,000,000 hp. A simple calculation will, he said, convince any expert that with such an intensity and energy reaching a certain area of the planet Mars, it is ample to produce a perceptible effect in a delicate instrument there.

In answer to a question as to return signals, he said he believed that these signals are being flashed now and waiting for us to answer.

Meeting of Boston A. I. E. E. Section.

The Boston Section of the American Institute of Electrical Engineers held a special meeting and dinner at Harvard University on Saturday, Dec. 4. In the latter part of the afternoon a large party met at Pierce Hall and was shown through the engineering laboratories of the university by Dr. A. E. Kennelly and Prof. C. A. Adams. At 6:30 p. m. dinner was served in Memorial Hall, the chief dining place of the university, and about 85 men were present. At 8 p. m. a meeting was held in the Jefferson Physical Laboratory, and an illustrated experimental lecture on the "Measurement of the Wave Length of Electromagnetic Waves" was given by Dr. G. W. Pierce, of Harvard University. It is planned to hold similar meetings at other colleges in the vicinity of Boston during the winter.

Rectification of Oscillation Valve.

A paper entitled "Conversion of Electric Oscillations into Continuous Current by Means of the Vacuum Valve" was read by Mr. W. E. Smith at a meeting of the Wireless Institute, held in the Engineering Societies Building, New York, on Dec. 1. The speaker exhibited two Fleming oscillation valves and explained in detail their operation when employed in wireless telegraphy. The valve consists of a low-voltage incandescent lamp, the filament of which is surrounded by a metallic band separated slightly from the filament, the intervening space being exhausted to a high degree. When the filament is heated by means of electric current from a battery of a few cells the space between the filament and the metallic band becomes ionized and possesses practically unidirectional conductivity. When inserted in a circuit subjected to electric oscillations partial rectification takes place on account of the high resistance for current in one direction and low resistance for that in the other. When arrangements are properly made from 80 per cent to 90 per cent of the oscillating current appears as unidirectional current. Either a galvanometer or a telephone receiver can be used as a detector of the received oscillations.

In the discussion of the paper it was stated that the De Forest "Audion" differs from the Fleming oscillation valve in that, with the former, use is made of a second isolated low-voltage battery to effect the ionization of the space between the filament and the metallic plate separated therefrom.

New York Public Service Commission News.

The Public Service Commission of the First District has sent a requisition to the Board of Estimate and Apportionment asking for an appropriation of $1,093,274 to cover the expenses of the commission for the year 1910, except the salaries of the commissioners and of the secretary, which are paid by the State. The commission spent $1,095,000 in 1908, and $1,174,000 in 1909. An additional sum will probably be necessary before the end of the coming year to cover the expense of securing the consents of property owners to new subway routes.

The Brooklyn Rapid Transit Company has outlined extensive rapid transit plans which involve the expenditure of something like $50,000,000. These plans will be submitted to the Public Service Commission within a few days. They include the equipment and operation of the Fourth Avenue subway in Brooklyn, the construction and operation of a line across Manhattan from Canal Street and North River to the new Manhattan Bridge, and the building and improvement of many lines in Brooklyn. The majority of this construction will be done at the expense of the railway company.

After several hearings on the subject of lighting in the subway, the Interborough Rapid Transit management has agreed with the Public Service Commission that it will replace the 10-cp lamps now in use with 16-cp lamps.

The Public Service Commission has issued to the Interborough Rapid Transit Company permission to begin work, with

the $1,500,000 voted by the city, on the lengthening of the platforms in the subway. The work will not be completed until next winter.

Engineers in the employ of the Public Service Commission are making preliminary surveys looking to the construction of a tunnel under the Kill von Kull from Bayonne, N. J., to Staten Island. This is part of a tentative plan for a rapid transit service all around New York Harbor, completing the circle with a tunnel under the Narrows.

The Board of Estimate and Apportionment has adopted a resolution requesting the Public Service Commission to prepare plans for a moving-platform railway under Thirty-fourth Street between Ninth and Second avenues. This is the result of the submission recently to the Board of Estimate of the proposals of the Continuous Transit Securities Company offering to build such a mode of transit under Broadway from Tenth Street to Forty-second Street.

A hearing on the application of the street railways within the jurisdiction of the Public Service Commission of the First District of New York, for modification of the car-heating order recently promulgated, by the elimination of the clause requiring the posting of the order in the cars, was held last week. Representatives of the companies said they would be willing to accept an order similar to that which governs the heating of cars in Massachusetts, which does not require the posting. They felt that in ordering the companies to post the notice the commission was invading the private property of the company and that in the future additional orders might be issued by the commission and the cars placarded with orders which are issued from time to time in the future. He said that as a result of the posting of the notice, the companies and the commission would undoubtedly be flooded with complaints which were not based on facts and that some passengers might even assume that the posting of the order gave them the right to call the conductor to account and that serious altercations might follow. Commissioner Eustis said that if the commission in New York were invested with the same police authority as the commission in Massachusetts and had in its service State policemen who were watching the cars at all times, it would be willing not to require the order to be posted.

Massachusetts Commission News.

The Worcester Electric Light Company has filed with the Massachusetts Gas and Electric Light Commission for the examination of the board an agreement with the Connecticut River Transmission Company relative to the entrance of hydroelectric power into Worcester from the plant and system of the latter organization at Vernon, Vt.

The Massachusetts Railroad Commission and the Boston Transit Commission are holding almost daily executive sessions in connection with the transportation questions referred to the joint board by the Legislature of 1909. Hearings have been concluded upon all the matters referred, and the board will make its report to the next Legislature in January. Among the important matters to be considered are the proposed terms of the consolidation of the Boston Elevated and the West End Street Railway; the proposed entrance of the Boston & Eastern Electric Railroad Company into the Boston metropolitan district; and the proposed bills for the construction of certain new subway lines in Boston submitted to the last Legislature. A petition has been presented to the Railroad Commission asking for a fare readjustment in the Hamilton district of the Boston & Northern Street Railway Company's system. The Boston Elevated Railway Company has secured the approval of the board for the proposed double track line to be laid in the Beacon Hill tunnel, the latter forming the Boston terminus of the subway now being built in Cambridge by the company. The new tunnel will connect Park Street, Boston, with the Cambridge bridge, where the subway lines will join the Boston end of the route. The Boston Elevated has filed plans with the commission asking its approval of the construction of a new station in Causeway Street, Boston, opposite the North Station of the Boston & Maine Railroad Company. The plans for this station include platforms to accommodate eight-car trains on tracks connecting with the East Cambridge extension of the company; a platform connection for the use of the South Station shuttle elevated trains, and passageways connecting with the present North Elevated Station. Detailed plans of the Malden and Everett elevated extension have been filed with the board by the company.

The Railroad Commission recently gave a public hearing on the petitions of the Boston & Worcester Street Railway Company for authority to issue new stock and bonds to the amount of $1,000,000. Among the plans of the company in connection with this issue, President W. M. Butler stated that the road intends to establish a trolley express service in its territory as soon as the legal obstacles can be overcome. A large number of freight stations will be built, and several express cars placed in operation. The chief difficulty at present to the inauguration of this development is the inability of the company to secure express-carrying rights in the cities of Boston and Worcester. It is considering a plan whereby motor trucks will collect and distribute freight outside its immediate system. Possibly the electric commercial truck may be pressed into this service, supplementing the transportation afforded by the interurban line over its own tracks, and thus completing the service from one end of its car routes to the other.

Canadian Hydroelectric Commission News.

The municipalities of Brampton, Milton, Port Credit, Mimico and Toronto townships, are likely to band together for the purpose of securing Niagara electric power through the medium of the Hydroelectric Commission.

Representatives of these places met Hon. Adam Beck, chairman, and the members of the commission in a lengthy conference on Dec. 3, with a view to obtaining co-operative action and determine the price on the aggregate amount of power to be taken. The commission stated that no prices could be quoted for the power until the amount to be taken was determined and how many centers would be on the station supply. Upon receipt of this information the commission will decide on the location of the transformer station. The representatives decided to confer with their respective Councils and prepare by-laws calling for the amounts of power required, which by-laws will be submitted at the January municipal elections.

All the municipalities are in the district between Hamilton and Toronto, so that they will be supplied from the main transmission line running from Niagara to Toronto, which will be completed early in the spring.

A reduction in the municipal electric power rates inside of two years is anticipated by the city electrical engineer. Mr. Aitken states that the municipal plant will be self-sustaining from the start, as the city will take enough power for its own uses to accomplish this.

The long and strenuous conflict which has been going on in Hamilton for the past three years over the question as to whether or not the city should have competition with the Cataract Power Company by taking in a block of electric power under contract with the Hydroelectric Commission, and mention of which has been made in these columns from time to time, came to an end on Nov. 29, when at a meeting of the City Council the Aldermen unanimously decided to enter into a contract with the commission for 1000 hp on the terms submitted by the commission. By the action of the Council the city is placed in an advantageous position, in that while having a contract with the Cataract company for street lighting at a very low price, the corporation has made a contract with the commission for 1000 hp for municipal purposes, including pumping, thus giving it the benefit of competition, while the other municipalities which have entered into contract with the Hydroelectric Commission have been bound to take power exclusively from the commission.

The city of Hamilton, in addition, has the right or option

until Dec. 31, 1910, to enter into an exclusive contract with the commission similar to the other municipalities. This question, which has been so prominent an issue in municipal circles, has thus been settled for a year when there will likely be a further contest between the opposing interests should the city corporation at that time wish to enter into the Hydroelectric contract exclusively. In another year the city will have had the use of both Hydroelectric and Cataract power and will be in a position to determine which contract is the more beneficial to the municipality.

The opposition to the Hydroelectric Commission is still endeavoring to secure the disallowance by the Dominion Government of the Provincial legislation. On Dec. 1, Sir Wilfrid Laurier was waited upon at Ottawa by Mr. R. G. Hutchins, Jr., representing N. W. Harris & Company, of New York, who have handled some $6,000,000 of bonds of Dominion Power & Transmission Company, of Hamilton. Mr. Hutchins urged the disallowance upon the ground that the Ontario legislation has had an injurious effect in regard to the securities issued by companies now operating in the territory proposed to be covered by the operations of the Hydroelectric Commission. The Premier informed Mr. Hutchins that the subject had been previously brought to his attention in several ways, and that the matter was under consideration.

Though the town of Port Arthur is still tied up and prevented from signing a contract for electric power with the commission, it has been learned that the commission will proceed with the construction of the power stations, transmission lines, etc., this work, according to Hon. Adam Beck, chairman, being contingent, however, upon the municipality resubmitting a further by-law to the ratepayers. Port Arthur has twice adopted a by-law in favor of hydroelectric power, and each time it has been stopped by technicalities. The contract of the town with Mr. Conmee's concern, the Ontario & Michigan Power Company, expires in March next, and, unless an agreement can be reached with the commission to go into effect before that time, the corporation will be compelled to sign an interim contract with the Conmee Company.

It has been learned that in all probability hydroelectric legislation will be dealt with at the coming session of the Ontario Assembly providing for an equitable and final method of disposing of disputes and differences which arise in the securing of right-of-way for the building of transmission lines. A good many differences have arisen in the past, some over values of property in which expropriation proceedings have been necessary. With a view to simplifying the procedure, expediting the decision and reducing the expense to the parties involved, it is likely that the Legislature will be asked to appoint by statute an official arbitrator, who will have authority to deal finally with all differences or disputes. No name has yet been mentioned for the position.

The commission has made peace with the farmers in the Niagara district who have been resisting the construction of the transmission line across their property, and, as a result of the agreement arrived at, it is expected that the work of installing the towers in that district will be completed within a week.

Wisconsin Rate Commission.

An application for a certificate of convenience and necessity has been filed with the commission relative to a proposed electric interurban railway between Madison and Janesville, Wis. A company composed of local and New York capitalists has acquired control of the Janesville City Railway, together with the present Rockford and Beloit interurban system, will give them an electric interurban service between Madison, Wis., and Chicago. The route as proposed by the Cincinnati Construction Company, which has the work in charge, includes the cities of Stoughton and Edgerton, as well as the summer-resort lake region in the vicinity of Madison. The price paid for the Janesville city system was approximately $45,000, the value fixed by the Railroad Commission.

The commission has authorized the La Crosse Street Railway Company to issue $50,000 par value of bonds of the denominations of $1,000 each. These bonds are to bear interest at the rate of 5 per cent per annum, payable semi-annually on the first day of July and January each year. The money derived from the sale of these bonds is to be used for the purchase of new cars, power-house equipment and for improvements and extensions on the track system.

The Northern California Power Company.

The Northern California Power Company is bringing to completion in northern California a series of hydroelectric power plants for utilizing all the water-power that can be developed from the streams of the Shasta section. The first power house erected was at Volta, on the north fork of Butte Creek, from which place the company began the distribution of power to Redding and Red Bluff. The second unit was begun on South Battle Creek, where a second and larger plant is now installed, the power here being developed from the water brought by ditch from the Volta plant, across Digger Creek around by way of Manton and over to South Battle Creek. It was also planned to use the waters of South Battle Creek, and to do this a ditch was begun some distance higher up in the mountains, and some time during the present month it is hoped to have this finished and water coming through it to augment the power now being created by the water brought from the Volta plant. To bring this water from South Battle Creek was no little undertaking. A pole line was built from Volta to the second unit to furnish power for work there, and now that line is transmitting power from this station to Volta. After the water is used at Volta it is poured back into South Battle Creek.

A third and larger plant is being constructed at Inskip, several miles below South Battle Creek station. A short distance below the second plant a dam is to be built that will divert the water from South Battle Creek, and by canal it will now be carried upon a tableland, the country here being much more level than above, and taken for some distance until it is united with a ditch that brings the water from Digger Creek near Manton, and then it is sent into the canyon to operate the machines at Inskip. The third plant uses the waters for the third time from North Battle Creek, the second time from South Battle Creek, and for the first time all the water that can be collected from Digger Creek and springs along the way.

CURRENT NEWS AND NOTES.

DENVER ELECTRIC CLUB.—Through the initiative of Mr. C. F. Oehlman, of the Denver Gas & Electric Club, and Mr. J. B. Griffith, of the Nernst Lamp Company, an electric club has been organized in Denver, Col. About 100 members have been enrolled, and permanent officers will be elected during the present week.

TOLEDO ELECTRICAL SHOW.—Arrangements have been completed for holding an electrical show in Toledo, Ohio, during the week commencing Jan. 31. The show will be under the auspices of the Electrical Dealers' Association, of which Mr. T. D. Buckwell is president and Mr. Irving R. Golden is secretary. The decorations will be uniform in design, and an amusement program will be a feature.

TELEPHONE BOYCOTT.—The merchants of Westville, Ind., a town of 800 inhabitants with two telephone companies operating therein, signed an ultimatum that unless the two companies consolidated and did away with the annoyance and expense of a dual system they would remove their telephones. The companies did not consolidate and the merchants removed their telephones. Now the people declare they will not trade with a merchant who does not maintain a telephone and there is much speculation as to the result.

NOBEL PRIZE FOR MARCONI.—Mr. William Marconi will be given the $20,000 Nobel prize for physics at Stockholm on Dec. 11, on account of his work in wireless telegraphy.

ELECTRICAL EQUIPMENT FOR COLUMBIA.—An anonymous donor has contributed $5,000 to be applied for equipment in the department of electrical engineering at Columbia University.

WIRELESS TELEGRAPHY.—At a meeting of the Wireless Institute, to be held in the Engineering Societies Building, New York, on Jan. 5, Mr. L. R. Gleason will present a paper entitled "Measuring Instruments and Measurements in Wireless."

WIRELESS TELEGRAPH SCHOOL.—The Maryland Institute of Telegraphy is the name of a new school which has been organized for the purpose of teaching wireless telegraphy. At present there are 12 students, who receive instruction three times each week from Messrs. T. E. Reese and E. J. Quigley, Jr.

A. I. E. E. MEETING.—The next meeting of the American Institute of Electrical Engineers, which will be held under the auspices of the high-tension transmission committee on Dec. 16, will be devoted to the presentation and discussion of a paper by Mr. Henry L. Doherty entitled "Comments on Development and Operation of Hydroelectric Plants."

COLORADO TOWN MAKES GROUNDING COMPULSORY.—The town of Holyoke, Col., has passed an electrical ordinance including the National Electrical Code requirements for spacing between high-tension and low-tension wires and other wires, for the grounding of all secondaries and for the partial support of electrical inspection by fee system.

WISCONSIN ELECTRICAL ASSOCIATION.—The next convention of the Wisconsin Electrical Association (which is an amalgamation of the old Northwestern Electrical Association and the Wisconsin Electric & Interurban Railway Association) will be held at the Pfister Hotel in Milwaukee Jan. 19 and 20. Several members of the Wisconsin Railroad Commission will be present at the meeting. Mr. J. S. Allen, Lake Geneva, Wis., is secretary of the association.

ELECTRICITY IN INDIA.—In discussing the advances made by electricity in India, Mr. H. P. Gibbs, chief electrical engineer of the State of Mysore, said that the Government is now contemplating the conversion from steam to electric operation of a railroad 80 miles in length now operated between Bangalore and Mysore. The former has a population of 200,000 and the latter 125,000. Both of these places are lighted by electricity. Plans are being made for operating by electricity the cotton mills at Bombay.

GOVERNMENT TEST OF WIRELESS.—Two United States scout cruisers, the *Salem* and the *Birmingham,* have been equipped with 10-kw Fessenden wireless telegraph sets for a four-months' test of the equipments under service conditions. The specifications call for the sending and receiving of messages over at least 1000 miles under all conditions and 3000 miles under favorable conditions. The vessels will attempt to remain in communication with each other while traveling through American, European and tropical waters, and to communicate with Brant Rock when within 3000 miles of the station.

GERMAN ARC-LAMP LITIGATION.—The German Imperial Patent Office gave an important decision on Nov. 22 relating to the mechanism of arc lamps. A firm had placed on the market an arc lamp without clockwork for use on direct and alternating current and for series connection. This lamp, it was claimed, infringed a patent of another arc-lamp manufacturer, and the case came before the Patent Office in an action for the cancelment of this German patent on the ground that its claims bearing on the non-use of clockwork were too broad. This contention was accepted and the patent was cancelled.

ELECTRIC RAILWAY RESULTS.—In a paper read by Mr. J. Shaw before the (British) Institution of Civil Engineers the advantages of electric over steam traction on the Mersey Railway in Liverpool were discussed in detail. The summarized comparative results of the change on the working and finances of the railway showed that the average speed, including stops, had been increased from 15.6 to 19.9 miles per hour, and the number of ton-miles per annum from 43,000,000 to 67,000,000, while the total expenses per ton-mile, after allowing interest on additional capital for electric works, had been reduced from 0.688 cent to 0.585 cent.

GERMAN CAPITAL FOR AMERICAN TELEPHONES.—In a report from Allentown, Pa., it is claimed that bankers in Hamburg, Germany, have invested almost $20,000,000 to finance the Continental Telephone & Telegraph Company of New York, which has purchased the American Union Telephone Company, with headquarters at Harrisburg. It is said that the principal object of the merger, which was brought about chiefly through the energy of Mr. Charles West, of Harrisburg, vice-president of the American Union, is the completion of an independent long-distance line from Boston to San Francisco, which already extends as far west as Kansas City.

DENVER HYDROELECTRIC SERVICE.—The Denver Gas & Electric Company and the Denver Chamber of Commerce are having conferences pertaining to the improvement of the electrical service of the former, especially with relation to recent conditions. The recent burning out of the largest steam-turbine unit at the company's West Side plant, and the consequent dependence upon the power of the Central Colorado Power Company, have resulted in frequent interruptions of service during the heavy evening peak over part or all of the city, sometimes lasting for 15 or 20 minutes. The investigation and conference are understood to be of a most friendly character.

BALTIMORE MUNICIPAL METER TESTING.—Inspection of private electric meters will be begun by the Department of Lamps and Lighting of Baltimore, Md., on Jan. 1. If the user of a private meter believes that he has been overcharged he will have the right to ask for an inspection, and if the reading of the meter proves correct he must pay $1 to the department. If the test shows that the meter is giving incorrect readings, he pays the fee, which is subsequently refunded to him and is charged against the company which furnishes the current. When it has been proved that a meter has been registering incorrectly, the company must rebate the consumer at the discovered rate of overcharge for the four months next preceding.

ELECTRICITY DIRECTLY FROM THE COAL MINE IN NOVA SCOTIA.—An electric generating plant using mine refuse as fuel has been placed in operation at the coal mines at Chignecto, Cumberland County, Nova Scotia. The equipment installed consists of a cross-compound condensing engine directly connected to a 750-kw, 60-cycle generator wound for 11,000 volts, and provision has been made for two more similar units. Energy is supplied to Chignecto, Maccan and Amherst, transmission lines having been erected to the latter two places. It is expected that energy will also be transmitted to Oxford, Sachville, Debert and Moncton. The installation is owned by the Maritime Coal Railway & Power Company, of which Hon. Wm. Mitchell, of Montreal, is president. Mr. David Mitchell is general manager, and Mr. Forest H. Mitchell is superintendent of the electric plant. The general offices of the company are at Maccan.

Norwegian 250,000-hp Hydroelectric Development.

By Einar A. Brofos.

NORWAY abounds in waterfalls, the water supply being quite constant throughout the year, partly owing to the high altitude of the water sources and the condition of the climate, with the exceptionally high rainfall. It is thus estimated that the total water-power of Norway amounts to about 7,500,000 hp, giving 3409 hp per 1000 inhabitants of the country. These figures exceed those of any other European country.

The possibility of hydroelectric developments is thus very large. This fact has been recognized in the last few years, several large plants having been erected, some of them ranging among the most important in Europe.

At present there is under construction in the Westfjord valley, in the district of Jelemarken, a hydroelectric plant which in many respects is considered to be the largest in the world. Advantage is taken of the Rjukan Falls in the River Maane, one of the largest waterfalls in Norway. By diverting the water from the river, at a distance above the falls, the available head is increased to about 1800 ft., which is being divided into two steps. Two plants will be erected, called Rjukan I and Rjukan II; the water after passing through the turbines of the first station will be led through a tunnel to the second plant and finally returned to the river. The rating of the plant is estimated at about 250,000 hp. These plants are being erected by the Narsk Kraftaktieselskab, and the power will be utilized by the Rjukan saltpeter works for the production of saltpeter from atmospheric nitrogen.

In Fig. 1 is shown a hydrographic map of the district of development. The River Maane being 20 miles long, and having its source in the Moes Lake at an altitude of 2958 ft., empties into the Tinn Lake. The difference in altitude between the lakes is 2334 ft. Of this head the 1800 ft. to be utilized is within a distance of 5.6 miles of the river. The drainage area of the River Maane is 662 sq. miles, while that at the Moes Lake is 570 sq. miles, the latter area containing a number of small lakes and rivers.

The Moes Lake, having at present a surface area of 22 sq. miles, is being arranged as a storage reservoir. To start with, a dam was erected during the years 1904 to 1906, through public means, for the purpose of serving as a regulating reservoir for the Tinn Lake. The dam, having a height of 57.5 ft. and a length of 427 ft., is a granite-covered concrete structure. The permissible storage height of 32.8 ft. above low water would effect a storage of about 19,800,000,000 cu. ft. of water. However, upon the decision to utilize the Rjukan Falls, the dam was to be enlarged so as to raise the storage height to 47.6 ft., the reservoir thus being able to impound about 28,200,000,000 cu. ft. of water. By this means the ordinary low-water flow, in the River Maane, of 212 cu. ft. per second may be increased to 1660 cu. ft. per second. The stored water may be emptied through two tunnels bored in rock, each 755 ft. long and having a cross-sectional area of 156 sq. ft. The dam has two spillway openings of 92 ft. and 94.5 ft. width and 8.2 ft. below the permissible storage height.

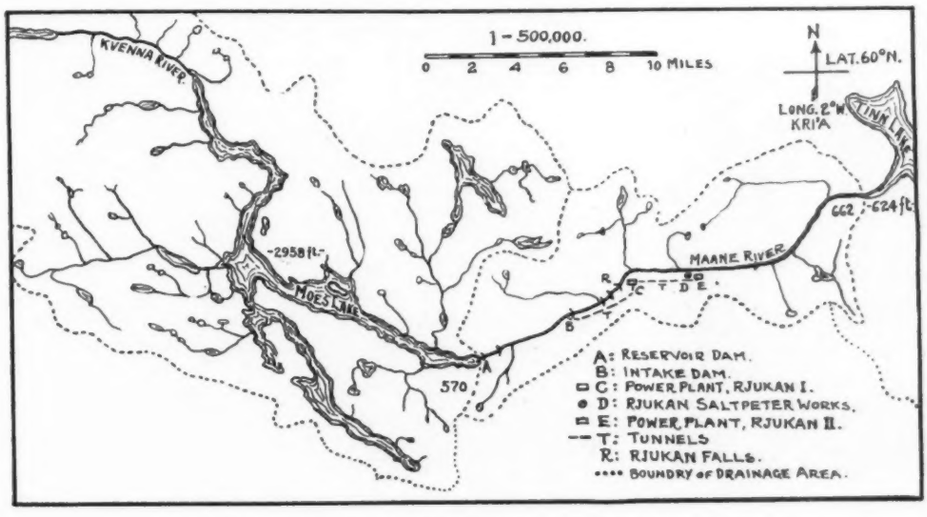


FIG. 1.—HYDROGRAPHIC MAP OF THE DISTRICT OF DEVELOPMENT.

About five miles from the reservoir is built the intake, shown in Fig. 2. A dam is thrown across the river, the water being

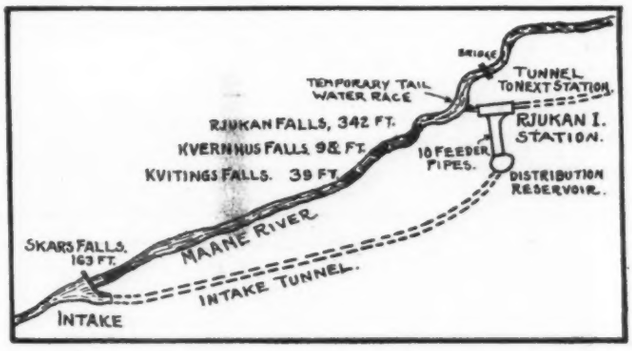


FIG. 2.—PLAN SHOWING LOCATION OF DIFFERENT FALLS AND POWER STATION.

diverted through a tunnel to a distribution reservoir. The intake dam, which is a concrete structure, about 300 ft. long, rises to a height of 42 ft. above the bed of the river and has a width of 36 ft. at the bottom. The length of the tunnel from the intake to the distribution reservoir is 2.64 miles; it has a cross-sectional area of 280 sq. ft., having a maximum height and width of 18.85 ft. and 18 ft., respectively, the gradient being 1 in 466. The tunnel, which is bored in solid rock for its entire length, is being worked at 20 different places, access to the intermediate points being available from the mountain side by means of nine smaller tunnels. The distribution reservoir, which is also blasted in the solid rock, has a volume of about 565,000 cu. ft. From this place the water will be led through five tunnels, about 80 ft. long, to 10 feeder pipes, about 2300 ft. in length, which will carry the water down to the turbines of the first plant. These pipes are of the seamless-steel type, the thickness of the plate varying from 0.39 in. to 0.98 in., the inside diameter being 4.92 ft. tapering to 3.94 ft. Due to unfavorable conditions of the ground, the feeder pipes have several gradients, the steepest, at the top of the hill, being 72 per cent. Owing to these variations in the slope of the pipes, they had to be securely anchored at the different points of grade variation, which is being done by means of large concrete castings.

The head of water at the Rjukan I plant is 905 ft. after deducting losses in the pipes, etc., the flow of water being 1660 cu. ft. per second, giving an effective 130,000 hp. The power house, which is situated about 460 ft. above the river, is being built of concrete with some reinforcements. It will contain 10 14,500-hp turbines of the Pelton wheel type, each connected to a 17,000-kva generator. The turbines, which are considered to be the largest yet manufactured, are being made by the firms of J. M. Voith, of Heidelheim, and Escher, Wyss & Company, of Zurich, Switzerland. The generators, which will produce three-phase, 50-cycle current at 11,000 volts, are being made by Brown,

Boveri & Company, of Baden, Switzerland. No transformers will be used, as the energy will be sent directly from the generator to the line. It is understood that the order for electrical machinery of this undertaking is the largest ever placed in Europe.

Figs. 3 and 4 show the location of the Rjukan I plant. Fig. 3 gives a front view of the plant, with the power house

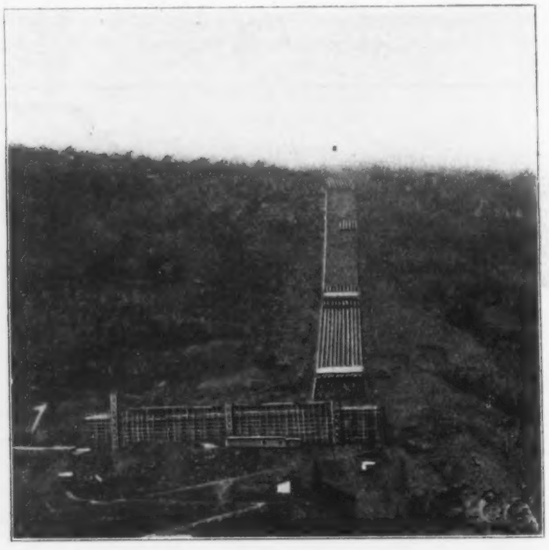


FIG. 3.—VIEW OF POWER PLANT.

during erection and with a portion of the feeder pipes installed. Fig. 4 shows an end view of the same plant. The location of the River Maane is about in the center of the picture. This illustration is a view looking down the valley toward the east. The saltpeter works and the second plant, Rjukan II, will be situated about 3.5 miles down the valley, behind the ridge to the right in the illustration. The tunnel for carrying the water from Rjukan I to Rjukan II will go through this mountain ridge; the length of the tunnel will be 3.42 miles, the cross-sectional area 280 sq. ft. The head of water for the second plant will be 787 ft. after deducting losses, and the plant is estimated to produce 117,000 hp.

The Rjukan I plant has been under construction for about

FIG. 4.—END VIEW OF POWER HOUSE.

two years and is intended to be ready by next fall. As the first plant will be ready for service before the second one, the water after passing through the turbines at Rjukan I will, until the completion of Rjukan II, empty into the River Maane from the end of the power house opposite the tunnel entrance.

It is interesting to watch this new industry of saltpeter production. In the small valley where the works are being erected there were, a couple of years ago, only some small farms; at present this great enterprise is being pushed and a town of perhaps a couple of thousand inhabitants has grown up. Primarily for the purpose of transporting the products of the works to the nearest point of connection to the coast, 28.6 miles of railroad has been built and ferry connection established on the Tinn Lake for a distance of 19 miles. Further down the same water course, at Notodden, for the last three years the company has been operating other saltpeter works, using 35 furnaces of the Birkeland-Eyde method. These furnaces consume from 30,000 hp to 40,000 hp obtained from the new Svaelgfos hydroelectric plant.

Padova-Fusina Single-Phase Railway.

By Mario Stoppoloni.

IN 1886 the "Società Veneta per Costruzione ed Esercizio di Ferrovie Secondarie Italiane" of Padova inaugurated the steam railroad between Padova and Fusina, intended to unite Padova with the Laguna and Venice and the great number of small towns located between on the banks of a navigable canal which units Padova to the Laguna.

Communication between Fusina and Venice is maintained by steamers of the "Società Veneta Lagunare," which cross the canal of Giudecca and land passengers at the pier of Piazza S. Marco. The great growth of industry which has occurred in Padova and its surroundings during the last few years, the great number of tourists who visit the church of St. Antony in Padova and lastly the great number of villas which have been built near this line made it necessary to increase the number of trains, their speed and also the comfort of the passengers. For this reason the "Società Veneta" decided to substitute electric for the old steam trains.

The work of electrifying the line was started at the end of 1907, and in the beginning of 1909 an electric train traveled for the first time over the whole distance from Padova to Fusina.

The line follows for some distance the provincial road of Padova-Fusina and on leaving Stra follows the navigable canal, crossing the River Brenta by an iron bridge.

The line is level the whole way except in crossing the bridge of Brenta, where there is a grade of 3.5 per cent.

The minimum radius of curvature is 180 ft., but due to the construction of the line and to careful study given to the design of the rolling stock, these curves are taken at a speed of 25 miles an hour.

With the electrification of the line, the line was prolonged to the center of Padova. So that starting from Piazza Garibaldi (Padova) one arrives at Piazza S. Marco (Venice) in 125 minutes, change being made at Fusina to the steamer.

The rails from Piazza Garibaldi to the station of S. Sofia are of the girder type of 92 lb., while for the line they are of the T-type of 56 lb. per yard; the rail gage is 4 ft. 9 in. The joints of the rails are connected by copper rail bonds of 0.082 sq. in. cross-section; every 100 yd. there are copper bonds of the same cross-section uniting the two parallel rails.

The trains are of 45 tons weight and reach a maximum velocity of 25 miles an hour. At present a train starts from each terminal of the line every hour with stops of two minutes in four stations, where there is a crossing, and 30 seconds in eight other stations, where there are no crossings.

The speed on the line between Padova (Piazza Garibaldi) and Stanga and on line between Dolo-Caffé and Oriago is very low, due to the great amount of traffic on these roads. The average speed is about 12 miles an hour—that is, the time consumed between Padova and Fusina is about 85 minutes. When the train staff and public have become accustomed to the new method of operation, the speed will be increased and it will be possible to reduce the time to 78 minutes without alternating the number of stops or the length of time spent at each, as has been shown on test runs.

On account of the length of line, about 22 miles, and because

the generating station could not be erected at the center, but had to be placed at Padova, a high-tension service was chosen. The system selected as having given some of the best results of late years was the single-phase. The motors are of the Winter-Eichberg commutator type built by the Allgemeine Elektricitäts Gesellschaft, of Berlin, and have properties similar to direct-current series motors. The e.m.f. is 6600 volts for the line between Stanga and Fusina and 600 volts between Stanga and Piazza Garibaldi (Padova), the frequency being 25 cycles.

The high-tension trolley wire is 21 ft. 4 in. from the rails, and the low-tension trolley wire 18 ft. The low-tension pantographs are so constructed that they cannot rise more than 19.5 ft. from the rails, as a safeguard against the low-tension circuit receiving high-tension current.

Use is made of the catenary system consisting essentially of an arrangement of a slack messenger cable and suitable hangers so distributed as to maintain the trolley wire practically without any perceptible sag between the points of suspension.

This arrangement permits the use of the minimum distance between hangers and necessitates the minimum stress in the trolley wire and thereby reduces danger of break in the line. This system offers the mechanical advantages of a long pole spacing, as the spacing of the poles is only a matter of weight of span which each pole can carry and of sag permissible in the messenger cable; moreover, there is the advantage of having more flexibility in the line which obviates the hammer blow of the collector at suspension points and reduces the danger of mechanical breakage.

On this line the poles are 165 ft. apart. The messenger cable consists of a steel wire 0.0093 sq. in. in cross-section. The hangers are of steel wire 0.00465 sq. in. in cross-section, with a spacing of 10 ft. between adjacent hangers. The messenger cable is supported by brackets and is insulated from them by porcelain petticoat insulators.

The trolley wire is displaced in a zig-zag manner by means of pull-off wires on the poles, so as to obtain an even wear on the pantograph. For curves the alignment of the trolley wire with respect to the center line of the track is maintained by

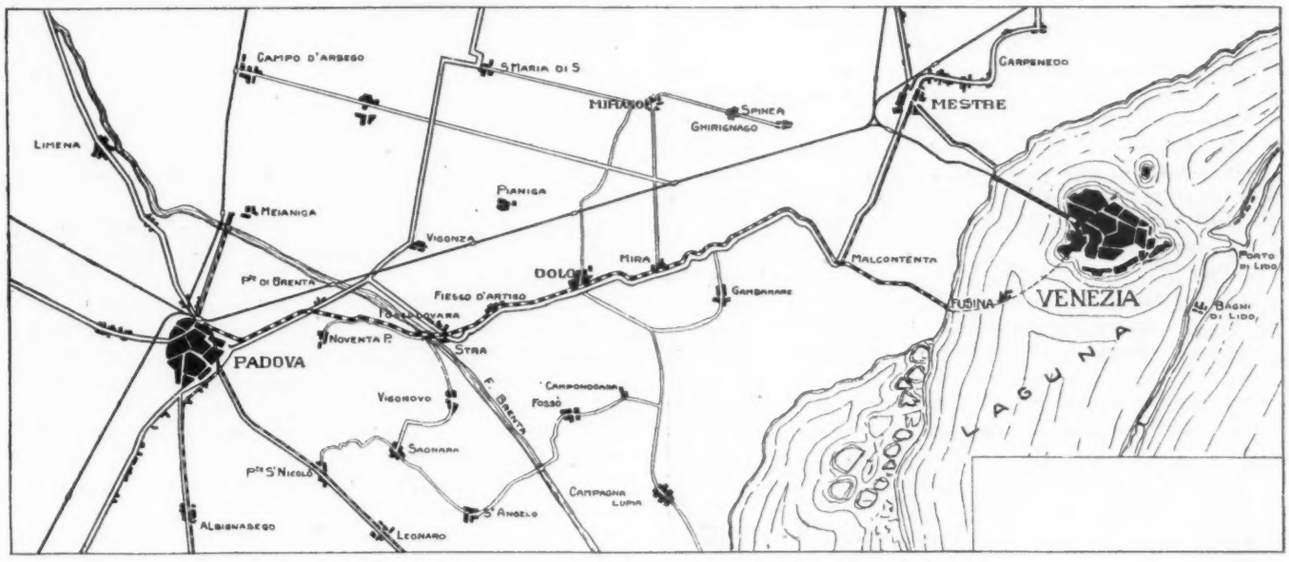


FIG. 1.—MAP OF ROUTE OF PADOVA-FUSINA SINGLE-PHASE RAILWAY.

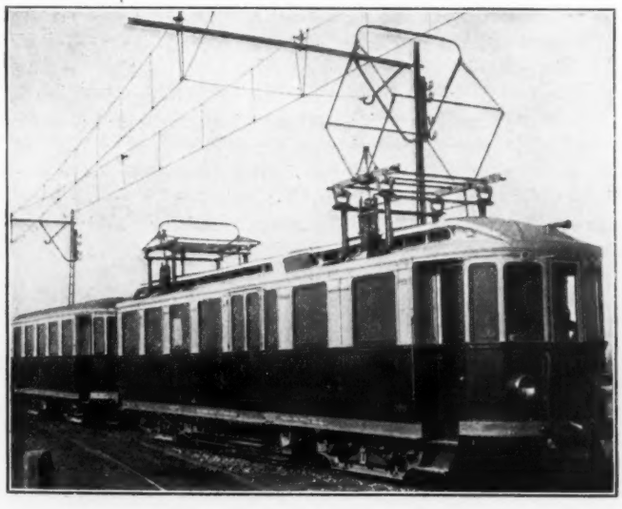


FIG. 2.—VIEW OF A COMPLETE TRAIN OUTSIDE A STATION SHOWING ALSO 6000-VOLT CATENARY LINE.

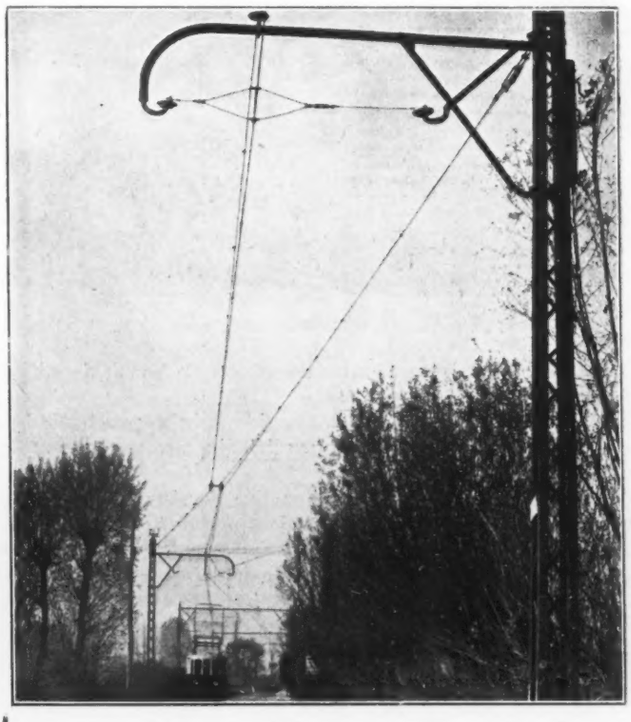


FIG. 3.—GENERAL VIEW OF CATENARY LINE CONSTRUCTION WITH STEEL BRACKET POLES.

bridle pull-offs acting on both the trolley wire and the messenger wire. As a safeguard against any danger occurring from breakage of insulation between the poles and the trolley wire the poles are connected to the rails by means of copper conductors.

At the end of the high-tension line there is an inclined section of trolley line, 10 ft. in length, insulated by two insulators, the other end of which is connected by means of an insulator to the low-tension trolley line. If in passing from the high-tension to the low-tension section the motorman has forgotten to lower the high-tension pantograph, the pantograph will be pushed down slowly by the slanting piece section of insulated line and will come into contact with the low-tension line, which is at only one-tenth of the high voltage and nothing will happen. Since the tension will be too low to make it possible for the train to proceed, the motorman will know that he has forgotten to lower the high-tension pantograph and to raise the low-tension one.

On the other hand, if when the train travels in the opposite direction and the motorman forgets to lower the low-tension pantograph on leaving the low-tension line, the pantograph will rise on the sloping insulated line until it reaches its maximum height, but it can never come into contact with the high-tension line.

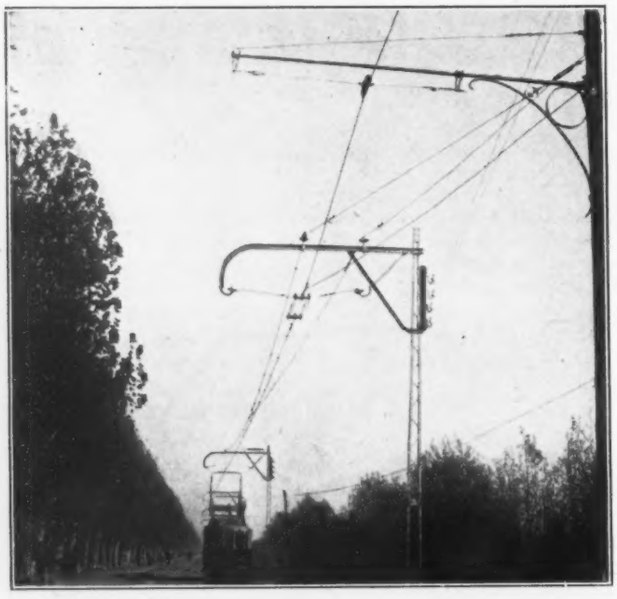


FIG. 4.—UNION BETWEEN 6600-VOLT LINE AND 660-VOLT LINE.

At 6000-ft. intervals there are section switches; each of the sections is protected by one or two lightning arresters mounted on the poles.

The feeder for the high-tension line consists of a copper wire having 0.082 sq. in. cross-section of copper, and is about 1200 ft. in length suspended on special poles. There are two feeders connecting at two different points, in parallel, for the low-tension line, the first being directly in front of the power house and the second about 7500 ft. distant, near the transformer house and car shed at Santa Sofia. The energy is transmitted to this substation over a 6000-volt feeder mounted on the same poles as the low-tension trolley line. The poles along the whole line carry the telephone and telegraph wires.

The rolling stock is composed of 10 motor-cars and five trail cars. All the cars were furnished by Maschinenfabrik Augsburg-Nürnberg, of Nürnberg. Each has seating arrangements for 44 persons and extra room for 12 standing. The first-class and second-class compartments are separated by a baggage-room, which can serve in case of heavy passenger traffic for seats for six persons, folding seats being provided for this purpose. Thus the motor-car can carry without any inconvenience to the passengers about 60 persons. The trail-cars have seats for 38 persons.

Each motor-car has two trucks, on one of which are mounted two 80-hp Winter-Eichberg motors; the other truck has only the air compressor with gear for the air brakes.

The motors are four-pole machines. The stator is wound like the primary of an induction motor, while the rotor is wound like an ordinary direct-current generator. Affixed to the pinion end of the armature is a fan which serves to ventilate the motor. The motors receive 600 volts at the brushes. When on the high-tension line the e.m.f. is reduced to 600 volts by a transformer fixed in the center of the car frame underneath the floor. Close to this transformer is mounted a smaller one which serves, by means of controllers, to regulate the speed of the motors; this transformer is used when running on the 600-volt line.

The energy before reaching the transformers passes through choke coils, before which there are taps connected to lightning arresters.

The high-tension circuit is provided with a fuse and an oil switch. All of the high-tension apparatus is placed in a kind of cupboard in the baggage-room. The door of this cupboard is locked automatically by the compressed-air circuit and the high-tension pantograph and cannot be opened unless the high-tension collector is lowered; for better security the high-tension circuit is grounded on opening the door. The motor and trail cars are furnished with air brakes of the Böcker system, and also with hand brakes.

The generating station is located 1.25 miles from Padova, at Stanga. It contains a machine-room, workshops and living-rooms for the staff. The machine-room contains two groups, each composed of a Woolf steam engine coupled to a 250-kw 6600-volt generator, and a third set, with engine of same type as the others, but an 180-kw generator. The boiler-room contains four Cornwall boilers working at 165 lb. pressure, furnished with superheaters and economizers.

Near the generating sets are two motor-generator sets, one kept as reserve, for charging the battery used for the station lighting.

In the machine-room below the switchboard there are four transformers, two for lowering the e.m.f. from 6600 volts to 600 volts, to feed energy to the low-tension trolley line, and two for lowering the e.m.f. from 6600 volts to 300 volts for the motor-generator sets and for motors in the workshops.

The switchboard is divided into two parts, one being level with the machine-room floor for the low tension, and one raised 9.5 ft. for the high tension. Behind the high-tension board are oil switches, series and shunt instrument transformers enclosed in separate imitation stone cells.

The outgoing feeders are provided with lightning arresters of the Wirt type and disconnecting switches. The tension is regulated by means of Tirrill voltage regulators, which work automatically on the exciter circuits.

Water-Power Resources of Texas.

By James L. Stapr.

THE water-power resources of Texas are just beginning to receive some of the attention that their importance justifies, according to the statements of men who have made a study of this feature of the State's undeveloped wealth. The fact has long been known that the available water-power of many of the streams of the State is very large. This is particularly true of the rivers which have their source in the more western and southwestern portions.

It is claimed that there is enough water-power going to waste within a radius of 150 miles of Austin and San Antonio to generate electrical energy sufficient to operate all of the industrial plants in the State. The lack of effort in the past to utilize these natural resources has been due chiefly to the sparsely settled condition of the territory adjacent to the avail-

able power sites. During recent years, however, the former isolated and thinly settled region has attracted the attention of homeseekers with the result that it is rapidly becoming populous with an energetic and progressive element of people who are quick to see the wonderful natural advantages in the matter of water-power that exist along the various streams.

The greatest step ever taken in Texas in water-power development was that made some years ago by the city of Austin when a dam across the Colorado River was built and a hydroelectric plant installed at a total cost of $1,600,000. The conservation of the flow of the river afforded a power for developing electrical energy for supplying the city with electric lights and power and for operating the street railway system. The power was also used by many private industrial plants and there was much more to spare. In 1900 a flood in the Colorado River destroyed this dam and washed away the hydroelectric plant which was situated immediately below it. But for this untoward accident it is believed many large manufacturing concerns would have been attracted to Austin on account of the free power that was offered them. The destruction of the great industrial enterprise left the city in bad financial shape, otherwise immediate steps toward the rebuilding of the structures would doubtless have been taken. The city at last finds itself in position for again considering propositions to replace the destroyed dam and power house and it is expected that some definite plan to this end will be agreed upon before a great while. The original dam was built of granite with a concrete filling. It was 67 ft. high and presented a solid breast to the water. Its destruction was due, it is claimed by engineers, to faults in the foundation underneath the dam, but there were probably other contributory causes. Borings have been made in the bed of the river at several proposed sites for the new dam under direction of the municipal authorities and these faults in the natural formation are found to be general. It is claimed, however, that a reinforced concrete dam can be built which will withstand any flood that may come down the stream and that the faults in the formation underneath the foundation of the dam would not make any difference so far as being a menace to the structure is concerned. According to the estimates that have been made the proposed reinforced concrete structure will cost much less than the original dam.

The Colorado River flows through a hilly country for more than 200 miles of its tortuous course. It enters the rough country a short distance below Ballinger and does not come to the broad valleys and broad scope of level territory until it gets below Austin. It winds between high cliffs and through narrow canyons in many places and at others it rushes furiously over precipitous falls. It is stated that there are many available sites for dams and hydroelectric plants along its course between Austin and Ballinger. In some localities great tracts of land could be irrigated from the water-storage reservoirs in addition to furnishing the power for the hydroelectric plants.

The natural falls at the town of Marble Falls on the Colorado River have long been noted for their power and beauty. In order to make them more effective a reinforced concrete dam is being built at an ideal site. The project embraces the erection of a hydroelectric plant and the building of transmission lines to a number of cities and towns, including Austin and San Antonio. The distance from Marble Falls to Austin in a direct line is about 30 miles, and it is only about 80 miles from the site of the proposed hydroelectric plant to San Antonio in a direct line. It is stated that approximately 25,000 hp can be made available at the Marble Falls plant.

Within a radius of 100 miles of Marble Falls are more than a score of thriving, important towns, ranging in population from 2000 to 100,000, San Antonio reaching the latter figure according to reliable estimate. It is a little less than 100 miles from Marble Falls to Waco in a direct line. In view of the fact that electric transmission lines are being successfully operated in Mexico and this country for distances of 200 miles and more the feasibility of the power project at Marble Falls is unquestioned. If one dam is not sufficient sites are available along that part of the river for the construction of as many more as may be necessary to supply the whole contiguous territory with power. The fact that the water can be used over and over again for this purpose makes its availability almost endless. It is expected that the introduction of cheap electric power will revolutionize industrial conditions in a wide scope of Texas during the next few years.

The Llano, San Saba and Concho rivers, all tributaries of the Colorado, also possess many splendid sites for hydroelectric plants along their respective courses. A large dam across the Llano River was recently completed at the town of that name and is affording the initial power for the electric plant at that place.

In the more western part of the State are the Pecos and Devil's rivers, which flow for great distances through deep, gloomy canyons. These gorges, by means of dams, could be made to store enormous quantities of water for the generation of electric power for turning the wheels of industry. It is said that the water-power resources of these rivers are equal to any in the country, and that in connection with the hydroelectric projects enormous tracts of rich lands could be reclaimed by means of irrigation. This is particularly true along the lower course of the Pecos River, where the water storage capacity is almost unlimited. So level is the land that extends back from the great, deep gap in the earth through which the Pecos River flows, that the water in many places could be brought above the surrounding surface in many places and led through canals and ditches over thousands of acres by means of gravity. The lack of railroad transportation in the Pecos River territory has retarded the agricultural and industrial development of that part of the State, but the Kansas City, Mexico & Orient and other lines of road are now headed in that direction and the big territory will soon fill up with settlers. The land is practically worthless unless irrigated. The river affords an abundant supply of water, and by building dams the storage reservoirs for power and irrigation purposes can be obtained.

Hydroelectric plants are destined to perform an important part in the land reclamation and irrigation enterprises of Texas, it is claimed. It has been demonstrated that where the water for irrigating lands has to be lifted, the pumping can be done cheaper and much more satisfactorily by electricity than by steam or gasoline engines. In the Laredo territory in the Valley of the Rio Grande, many of the Bermuda onion growers get their power for operating their irrigation pumps from the electric plant at Laredo.

The water-power of the Guadalupe River is being used for generating electrical energy at a number of places along its course. This stream rises in the mountains of middle western Texas and has many steep rapids and falls on its way to the Gulf. It was along the Guadalupe River that Mormon settlers of the early days established their grist mills and other industries, using the never-failing water to turn the cumbersome wheels. Between New Braunfels and Seguin, a distance of about 15 miles, following the course of the Guadalupe, is said to be an enormous amount of water-power which is now going to waste. Plans are on foot for utilizing some of this power for generating the electrical energy to operate a proposed interurban railway to be built to San Antonio.

It is within a territory extending west and south of Austin for 100 miles that the greater part of the available water-power resources, except that of the Pecos and Devil's rivers, exists. In the other parts of the State the rivers are slow and sluggish and have banks so low that it would be impracticable to dam them with any degree of success. This is true of the Brazos, Trinity, Neches, Sabine and other rivers.

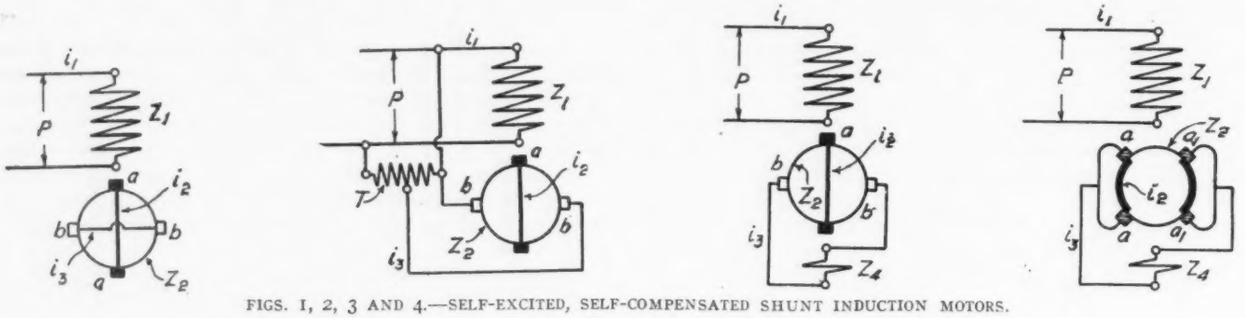
In the absence of any survey of the streams of the State with reference to their water-power resources, it is impossible to give any reliable estimate of the amount of this source of wealth, but it is known to be very great, and more than ample for present industrial needs of the territory that can be reached by transmission lines.

Factors Affecting the Design of Self-Excited, Single-Phase, Shunt Induction Motors.—I.

By Val. V. Fynn.

In an earlier issue the author outlined the no-load conditions in an ideal self-excited, single-phase, shunt induction motor—that is, in the machine known in America as the single-phase induction motor. The present article deals with practical forms of this motor, as shown in Figs. 1, 2, 3 and 4, and discusses the design of such machines.

In turning to the consideration of machines which are *not* devoid of losses, it is thought preferable to treat them as if the question of recoverable energy required by the rotor, as discussed in the previous article, did not exist; this is the more justifiable as this feature of the machine is perfectly independent of all other phenomena taking place in the motor. The foregoing discussion of this question will show how the results which will be arrived at in each of the following cases should be modified in order to allow for the influence of this elusive factor. A knowledge of the value $\frac{1}{2}mv^2$ is necessary in every case.



FIGS. 1, 2, 3 AND 4.—SELF-EXCITED, SELF-COMPENSATED SHUNT INDUCTION MOTORS.

The influence of the recoverable energy on the final results can only be serious if $\frac{1}{2}Li^2$ is large; other considerations generally preclude this possibility. When not otherwise stated, the torques to be referred to hereafter will all be average torques referring to irrecoverable energy.

Assume a self-excited shunt induction motor, the rotor windings of which have ohmic resistance, but no reactance and which has no iron losses; thus, say, $w_2 = 2$ ohms, $x_2 = \Theta_2 = \Theta_3 = 0$. As a further simplification and one which in no way affects the deductions, assume the primary winding to be devoid of losses, so that $w_1 = x_1 = 0$.

At no-load speed such a motor must take a certain amount of magnetizing current to supply the "recoverable" energy required by the transformer field. It must also take a certain number of watts and produce a certain torque in order to supply the following irrecoverable energy required by the motor:

(1) The copper losses in the primary.

(2) The copper losses in the secondary along the transformer axis.

(3) The iron losses along the transformer axis.

(4) All negative torques, if such exist.

(5) The friction losses.

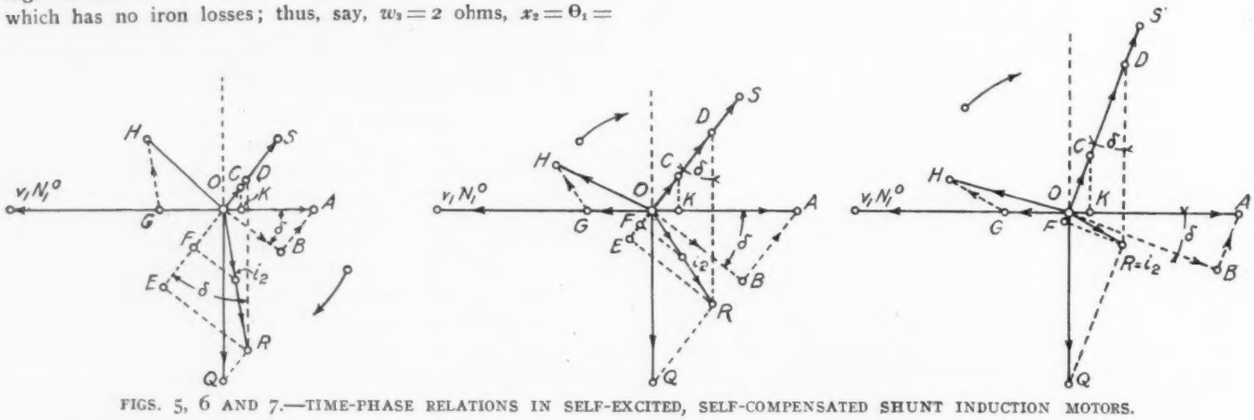
(6) The ventilation losses.

(7) The iron and copper losses in the exciting or motor field circuit.

The recoverable energy required by the rotor, be it by the motor field or by a demagnetizing component of the rotor current along the armature axis, will be at least partly met by a corresponding component of the primary or stator current and will also draw on the kinetic energy of the rotor.

The first three losses will be supplied directly by the primary stator winding, the next four will, as a rule, be entirely met by a rotor current in the transformer axis, which current will, of course, be reflected in the primary both as to phase and magnitude. It will indeed be remembered that the motor acts as a *phase converter* when producing the exciting current i_3 in its rotor along the motor field axis; this converter must be *driven* at a certain speed, and if not devoid of losses, it will require a certain average torque in order to maintain it at that speed. This torque will, as a rule, require a current i_2 flowing in the rotor along the transformer axis and interacting with the motor field N_3. This current i_2 will be reflected in the primary stator winding because it flows through the rotor along the transformer axis.

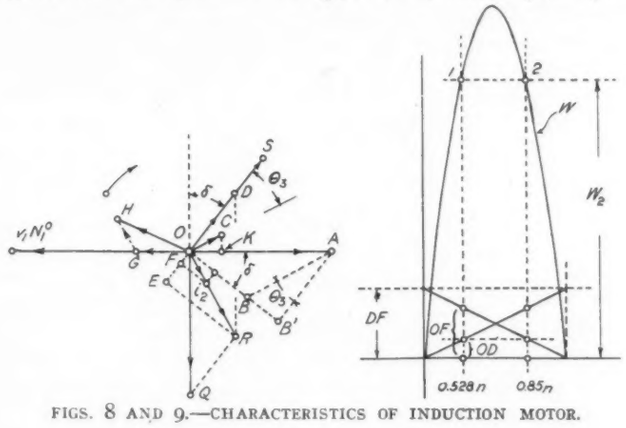
Turning now to the figures illustrating these no-load conditions it should be noted that the rotor resistance chosen for Figs. 5, 6, 7 and 8 is quite abnormally large and has been so chosen in order to make the diagrams very clear. In these figures $OD = e_{r3}$; $OF = t_{i2}$; $GH = -i_2$; $OH = i$; $OQ = e_1$; $OS = N_3$; $OB = -e_3$; $OC = i_3$; $OK = t_{i3}$; $OG = i_m = i_0$; $OA = e_{r1}$; $BA = -i_2 w_2$; $w_1 = x_1 = 0$, and $x_2 = 0$. In Figs. 5, 6 and 7, $\Theta_3 = 0$. In Fig. 5, $w_2 = 2$, and $n = 0.528$. In Fig. 6, $n = 0.85\, w_2 = 2$; in Fig. 7, $n = 0.995$ and $w_2 = 1$, while in Fig. 8, $n = 1.00$, $w_2 = 2.667$ and $\Theta_2 = 24$ deg. In these figures the torque D_3, due to the interaction of i_2 and a small part of N_2', must be zero for x_2 and consequently the secondary leakage field N_2' is supposed to be zero. On the other hand, the torque D_1, due to the interaction of $v_1 N^0_1$ and i_3, has a definite and *negative* value, for it is seen that the effect of w_2 is to shift the



FIGS. 5, 6 AND 7.—TIME-PHASE RELATIONS IN SELF-EXCITED, SELF-COMPENSATED SHUNT INDUCTION MOTORS.

phase of N_3 out of its time-quadrature relation to $v_1N^0_1$, making angle $GOS > 90$ deg.

Although e_{r1} will still equal e_1 for $n = 100$, yet N_3 will be considerably smaller than $v_1N^0_1$ for it is only proportional to e_3 which equals $\overline{e_{r1} - i_2w_2}$. Since the phase of e_{r3} depends on that of N_3 it can in this case never be opposite to the phase of e_1; thus the resultant OR between e_1 and e_{r3} can never be zero and a current i_2 in phase with OR must flow in the rotor along the transformer axis under all conditions of speed and *whether such a current is required for the production of a torque or not.* At synchronism i_3 will have a certain value smaller than i_m in the proportion of e_1 to e_3, it being assumed in this case, as in all the others, yet to be considered, that the primary and secondary windings are exactly equal, that the e.m.fs. are proportional to the fluxes and that the reluctance is constant along all the axes of the motor. The resultant e.m.f. in the rotor along the transformer axis will at synchromism be exactly equal in magnitude to BA, which in this case equals i_2w_2. At synchronism OR will be in time-quadrature with BA, leading BA by 90 deg.; in consequence, $i_3 < i_m$ will be exactly reflected in the rotor along the transformer axis and also in the primary stator winding, being there added vectorially to i_m, thus yielding the resultant i or OH. In Figs. 5, 6 and 7 i_2 will at synchronism coincide in phase with e_3 or OB, but i_2 will then also be at right angles to N_3 and the average main torque D_3 of the motor will thus be nil. If the speed be increased beyond synchronous a reference to Figs. 5 and 7 will show that D_3 must become negative. D_3 is due to interaction of i_2 and N_2. Therefore:



FIGS. 8 AND 9.—CHARACTERISTICS OF INDUCTION MOTOR.

The no-load speed of a shunt induction motor, the rotor of which has resistance only, must be below the synchronous. The average main torque D_3 of such a motor becomes zero at synchronism.

Suppose that the motor losses 4 to 7 are such as to require, say, W_r watts in the rotor along the transformer axis, in order to drive the machine light, then $t_{i2} \times e_{r3}$ must equal W_r, where t_{i2} is that component OF of i_2 which is in phase opposition to e_{r3} or OD. Seeing that OE is the torque component of OR, just as OF is the torque component of i_2, the matter resolves itself into the problem of finding that position of the triangle EDR or that rotor speed for which $OE \times OD$ has a given value. It is quite clear that there will always be *two* such positions as long as the no-load requirements are within the power range of the machine, consequently two distinct speeds will correspond to these two positions of EDR. The variation of the individual values of OF and OD, together with the variations of their product, are graphically shown in Fig. 9 for all positions of the triangle EDR—that is, for all speeds up to the synchronous. It is seen that $OD = e_{r3}$ varies as the square of the speed; whereas OF has a definite value $\frac{e_1}{w_2}$ when the speed n is zero and is itself zero when the speed is synchronous. OF varies proportionally with OE and its value at any speed n is $OF = \frac{e_1}{w_2}(1 - n^2)$ where n must be expressed as a fraction of the synchronous speed. The motor diagram for the lower speed, point 1 in Fig. 9, is shown in Fig. 5; that for the higher speed, point 2 in Fig. 9, is shown in Fig. 6. It is obvious that the equilibrium at the lower speed is unstable, whereas at the higher speed it is quite stable. In the first case, an increase in speed causes the power available to increase and vice versa, so that the motor will tend to run beyond point 1 of Fig. 9. In the second instance, a decrease in speed increases the power available and vice versa; these last conditions, therefore, tend to keep the speed constant. Fig. 7 merely indicates that a decrease in the rotor resistance tends to increase the stable no-load speed and also to decrease i_2. Although it has been assumed in Fig. 9 that the no-load watts required at the two speeds are of same magnitude; this is, of course, not generally true; the fact has, however, no bearing on the above deductions. We can say that:

When the rotor of a shunt-induction motor, otherwise devoid of losses, has only ohmic resistance, then its primary no-load current is made up of two components, the primary magnetizing current and a current equal and opposed to the rotor current in the transformer axis. This latter is made up of two components in quadrature relation, the one i_{2c} is constant and equal to the synchronous rotor exciting current i_3 of the machine, the other i_{2v} is equal to $\frac{e_1}{w_2}(1 - n^2)$ where n expresses the speed as a fraction of the synchronous; this no-load rotor current is neither equal to the primary magnetizing current in magnitude, nor opposed to it in phase.

The torques are:

$$D_1 \equiv v_1N^0_1 \times i_3 \times \sin \delta$$
$$D_2 = 0$$
$$D_3 \equiv i_{2v} \times e_{r1} \times \cos \delta$$

The influence of iron losses can be ascertained with the help of the diagram in Fig. 8, for which δ is the same as in Fig. 6, but where $w_2 = 2.667$.

Iron losses along the motor field axis increase the watt component of the no-load current along the transformer axis and may be looked upon to some extent as an increased rotor resistance. The torques are:

$$D_1 \quad v_1N^0_1 \times i_3 \sin (\delta + \Theta_3)$$
$$D_2 = 0$$
$$D_3 \equiv i_{2v}(e_{r1} \cos \delta - i_2w_2 \sin \Theta_3)$$

It is seen that D_3 does not become zero at synchronous speed when $\Theta_3 > 0$, yet the motor cannot run at synchronism, even at no-load, for at that speed $D_1 > D_3$.

It will be shown in a later issue that OR is always equal to BA and in time-quadrature therewith at synchronism (even when $x_2 > 0$), but that BA does not always equal i_2w_2. Although as soon as $x_2 > 0$, that is, as soon as a practical machine is dealt with, the conditions change very materially, yet it is thought that the foregoing considerations will be of material assistance in dealing with the more complicated conditions obtaining in a commercial machine and will be of assistance in ascribing the various effects to their proper causes.

Determining Positions of Vessels by Wireless.

A patent issued on Nov. 30, 1909, on an application filed on Dec. 14, 1904, by Reginald A. Fessenden, relates to a method for locating the position of ships by means of wireless telegraphy. According to the arrangement proposed, signals are sent out at regular intervals from two or more wireless telegraph stations situated at fixed points, each vessel locating its own position by comparing the strengths of the signals received. Each land station sends out a distinctive signal so that it may be recognized immediately by any vessel. Moreover, the strength of the signal from each land station is varied so as to form a succession of signals of gradually varying intensity so that each signal shall produce the same intensity at a point 20 miles farther from the station than the signal immediately preceding it. Thus the operator on each vessel first identifies the station from which each signal is being sent, estimates the relative distances from the vessel to each land station and thereby determines the position of the vessel on the sea.

English Tariff Reform and American Manufactures.

By an English Observer.

THERE can be no doubt that the question whether England shall adopt protection is one of the leading political topics of the present day in the old country. At the present moment, of course, the Radical party, which is in power, is making the budget for 1909-1910 the chief plank in its platform. The Prime Minister and those who support him are stanch free traders, and the financial proposals now before Parliament do not involve any departure from the principles of free trade. By means of additional taxes on land, liquor and increased death duties it is hoped to secure sufficient revenue to run the country. At the moment of writing this free-trade budget has been passed by the House of Commons, but it has to receive the sanction of the House of Lords before it can become law. Speculation is rife as to whether it will survive this ordeal. Although it was passed by a huge majority in the House of Commons, that really counts for very little, because the present Parliament was elected in 1906, and since that time there has been a great change in public opinion. The House of Lords, by throwing out the budget, may force another general election, in which case the free-trade government may be turned out of power.

The main item in the program of the party which is in opposition is tariff reform, and, whatever may be said to the contrary, there is undoubtedly a growing feeling in favor of this change.

It is asserted on every platform that England is losing her supremacy as a manufacturing country. The British workingman is told that he is being deprived of his means of livelihood by the free importation of foreign goods. It is pointed out that many industries have been killed in England owing to the fact that German and American goods are allowed to come in without any restrictions, and are sold at prices which ruin the British manufacturer. For instance, in 1907, glass tumblers sold at 2s. in the United States were sold in London at 1s. 3d.—about what they cost to produce including freight. In support of the argument as to England's being cut out by America, figures are quoted to show the enormous expanse in the production of American steel. Thus, during the period from 1880 to 1907 steel production in the United Kingdom increased from 1,000,000 tons to 6,000,000 tons. In the same period the steel output in the United States increased from 800,000 tons to 23,000,000. Finally, the fact is emphasized that in all the skilled trades the rates of pay are much higher in the States than they are in England. Thus, the wages of engineers in America are from 35 per cent to 70 per cent higher than those of men in similar employment in Great Britain.

The present article is not concerned with the proper economic deduction which should be drawn from these facts and figures. The broad point is that they are being emphasized all over England and are drawing her on to tariff reform. The success of protection in America is often looked upon with jealous eyes, and President McKinley's famous decision, "We want no free trade in the United States . . . the capitalist can wait on his dividends, but the workingman cannot wait on his dinner" is freely quoted.

What is the program? What kind of reform will it be? If duties are imposed upon foreign goods, coming into England, what goods will be included in the schedule? Last, but not least, how will such duties affect the position and interests of the foreign manufacturer?

Each of these questions can be dealt with in turn. In the first place, it is by no means easy to define the program of the tariff reformer.

The main features of the program may, however, be thus summarized:

(1) A tax is to be placed on all manufactured articles coming into Great Britain in competition with her products.

(2) Raw materials are to be free.

(3) No extra taxes to be placed on food.

The last item is of no particular interest to the *Electrical World,* but the first two demand some consideration. To begin with, it is clear that all electrical machinery sent to England from the United States will be taxed. The amount of the tax has been vaguely stated to be 10 per cent ad valorem; but whether this figure will be effective to keep out American goods is not yet known.

When one comes to look at figures, it would seem that the imposition of this tariff is not a matter which need disturb the American manufacturer very much. No figures are available to show the actual value of electrical machinery imported into England, but when one views the figures relating to imported manufactures as a whole it would seem that the United Kingdom during the last few years has not become a much better customer for America. Thus, in 1904 England imported American-manufactured goods (that is, articles wholly or mainly manufactured) to the value of $98,000,000. In 1907 this had only increased to $101,500,000. The fact can be explained better in the States than in England, but the plain English of it seems to be that so far as manufactured articles are concerned the Americans have but little to worry about.

Another fact is forced into notice. Suppose this tax is put on, who will pay it? This appears to depend very largely upon the question whether the goods to be taxed can or cannot be manufactured in the United Kingdom. If they are not manufactured in the Kingdom it seems to one who does not claim to be a political economist that for a considerable time at least the American may put up his prices. Of course, if they can be manufactured in the Kingdom, then the English manufacturer will have a preference to the extent of the duty, and the question whether the American goods will continue to come in will depend largely upon their quality and the cost of production.

As to the latter point, it may be remarked that whatever duties are imposed, a certain number of American manufactured goods will continue to come into England and to hold the field. In spite of huge American tariffs certain classes of English goods continue to cross the water.

It has been noted already that, whatever happens, raw materials are to be admitted free. The true importance of this exception could be better gaged if one has a definition of raw materials. Steel plates are the raw material for building ships. Copper wire is some of the raw material for manufacturing dynamos. It is to be noticed that manufactured goods are to be taxed upon a graduated scale. The higher the degree of manufacture the more, it is presumed, will be the duty.

The above somewhat sketchy outline gives a faint idea of what is meant by tariff reform in England. If it means more than this, the meaning has not been divulged. It is wrapt in mystery in its inception; and the consequences which will follow from it are a matter of speculation. It is almost impossible for a political economist to form an accurate judgment in the matter. The case is without precedent. When America adopted a tariff, she was, comparatively speaking, a new country. To encourage manufacture at home she put on protective duties, and the result has been, to all appearances, successful. When Bismarck took the same step, Germany was in her infancy as a manufacturing community. She, too, has reaped a rich harvest. But what will be the result of protection in a country which remained great in spite of free trade? Will protection bolster up declining industries? English free traders say no. They assert that free imports are the lifeblood of England's commercial prosperity. They also argue that import duties raise prices by the whole amount of the duty, and that, therefore, as the price of the untaxed product is raised equally with that of the taxed product, the loss to the community is greater than the gain to the Exchequer. How far these prophecies are true time alone can tell. However, it is certain that there is a strong and growing feeling in England at the present time in favor of tariff reform, and all American manufacturers should begin to consider how they are going to deal with the new fiscal situation to which it will give rise.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Electric Automobile in Springfield, Ill.

The Springfield (Ill.) Light, Heat & Power Company has been meeting with gratifying success in building up an electric vehicle charging business. The matter of an automobile load was taken up early in the year and at present the company is charging regularly 22 vehicles. In addition, some vehicles are charged at public or private garages to which the central station supplies electrical energy. The rate to automobile owners is 5 cents per kw-hour.

A Glue-Pot Advertisement.

The Roanoke (Va.) Traction & Light Company recently took advantage of a local fire originating in a glue pot to issue a circular setting forth the advantages of the electric glue pot. The circular has the "scare-head" Fire! followed by a reprint from a local paper giving an account of the fire. Then, after the question in large type, "How is your glue pot heated?" a few sentences set forth concisely the advantages of the glue pot. The design of the advertisement is such that no one could escape being attracted to its brief message.

Prompt Work.

The Lawrenceville (Ill.) Light & Water Company is on the spot ready for business when it gets an order for house wiring, as is shown by a seasonable advertisement being run in Lawrenceville papers, the wording of which is as follows:

"A Lasting Christmas Present and a Most Desirable One for Your Wife Would be Electric Lights in the Home."

"A Proposition.—Get your wife away from home for the day and we will wire the house and have the lights burning by night. Why not surprise her? Women like pleasant surprises."

The Furnace Fan Season.

Central stations and electric supply companies which are making the most of their opportunities are at this time of year preparing again for cold weather by laying in a stock of electric fans for use in connection with hot-air furnaces. An electric fan placed in the air intake of a hot-air furnace to force the hot-air circulation makes it possible to do satisfactory heating with hot-air furnaces where otherwise steam or hot water would be necessary to heat distant rooms. It also facilitates the warming up of a house on cold mornings. The use of electric fans for this purpose by the occupant of a furnace-heated house in northern latitudes is likely to exceed his use of the fan for cooling in summer. This kind of business, however, must be taken at the psychological moment, when the weather is cold, and the only way to be prepared for it is to have fans on hand ready to install. The ordinary 10-in. or 12-in. desk fan can be placed in a box, one side of which is open and the other side is closed except for a circular opening the size of the fan. This can be placed so as to slide vertically or horizontally into the cold-air box of the furnace. Special outfits with slow-speed fans are also made for this purpose now by certain manufacturers.

Low-Voltage Tungstens in Residences.

The question of whether it is advisable to install low-voltage tungsten lamps taking 30 volts or 60 volts instead of the regular 110-volt lamp, which is more fragile, has been coming up frequently. The object of using such low-voltage lamps is, of course, the greater strength of the filament for a given candle-power, which reduces breakages and enables lamps of lower candle-power to be used. Several enterprising central-station companies have installed these low-voltage lamps in small residences at a flat rate per lamp per month, on the theory that this will secure a number of small consumers which would not otherwise be obtained, and the expense of meter investment and maintenance is done away with.

The objection has been raised, however, that the use of low-voltage tungsten lamps for ordinary residence use, either with or without meter, has many drawbacks, about the only substantial advantage gained being the greater strength of the lamp filament for a given candle-power. Low-voltage circuits shut out standard heating appliances. From the illuminating standpoint, there is no great call for tungsten lamps giving less than 20 cp at the present time. To be sure, there are places where much less than 20 cp is sufficient, but in the ordinary house there are places where the lamps are infrequently used, and it is generally better to retain carbon lamps in the sockets which are infrequently used than to make the extra investment with risk of breakage by putting tungsten lamps in these sockets. This virtually means that tungsten lamps, on account of their high price and fragility, will for some time to come be used mainly in the sockets where needed most. In the ordinary small house these sockets are in the kitchen, dining-room and living-room, with occasionally a bedroom. Now, while it is true that with proper observance of the principles of illumination, an 8-cp lamp can be made very satisfactory for lighting a dining-room table or providing enough light for two or three people to read under in a living-room, it is hardly up to present-day ideas of sufficient illumination with electricity. People in general expect more illumination with electric light than with kerosene. As to comparison with gas, the smallest candle-power burner to which gas users are accustomed is 16 to 20, while gas-mantle burners run from 20 cp to 80 cp. It would seem, therefore, that the central-station man in shaping his policy in these matters should seek to cater to the increasing standards of illumination and the demand for more light on the part of the public, rather than to adopt odd voltages and low-voltage lamps.

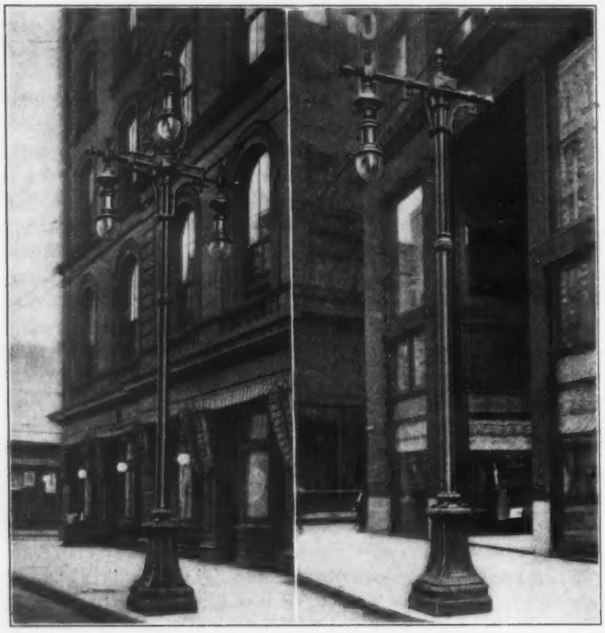
The low-voltage tungsten lamp supplied on a flat rate of about 1 cent per month per candle-power is not without its advantages. It does away with meter investment and other expense connected with meter reading and maintenance. The fact that the cost is known in advance to the consumer appeals to many. As long as low-voltage tungsten lamps are not easily available in the larger candle-powers, it is unlikely that customers will attempt to substitute larger lamps unknown to the company. This, however, is likely to be a temporary condition. Substitution in the long run can only be checked by regular inspections or by the use of flat rate or maximum-demand controllers which allow only a predetermined load to be connected. The cost of these controllers is a partial offset to the saving in meters, although the controller has the decided advantage that it does not need to be read, and costs somewhat less than the watt-hour meter. The point that the low-voltage, small candle-power tungsten lamps can be used in existing old-fashioned fixtures is after all a questionable advantage. These old-fashioned fixtures are likely to be of such unsatisfactory design and equipment that the consumer would do much better with a single tungsten lamp of higher candle-power efficiency installed and equipped.

Improved Street Lighting in St. Louis.

Before the beginning of the new year, St. Louis will have completed and in operation what is said to be the most extensive, most up to date, and most effective street-lighting system of any American city. The work of arousing sentiment

in favor of a new lighting system in the business district of St. Louis and carrying the project to successful completion was placed in the hands of the officers of a voluntary organization, composed of merchants and property owners within the district, known as the Down Town Lighting Association.

It had been realized by the merchants and property owners that a new lighting system was badly needed in the business district, and it was finally agreed that some steps should be



FIGS. 1 AND 2.—THREE-LAMP AND SINGLE-LAMP STANDARDS.

taken looking to the improvement of conditions. The new organization began work immediately after the beginning of the present year. Committees were appointed, to which were delegated the duties of making a thorough investigation of all existing forms of street illumination, and of devising the proper system adapted to conditions in St. Louis.

After more than eight months of labor, it was decided to install an improved form of arc-lamp lighting, and by process of elimination the new magnetite arc lamp was fixed upon as the unit of illumination. This having been established, a committee was appointed to design a suitable lamp standard which could be manufactured and erected at moderate cost, and which would eliminate the unsightly service loops which had heretofore been an unsightly feature of the arc-lamp standards. The new lamp standard called for the fixation of the lamp.

The above points having been settled, the entire plans were laid before the Board of Public Improvements of the city of St. Louis for its approval and adoption, so that the maintenance

FIG. 3.—BROADWAY (ST. LOUIS) BY NIGHT.

charges would be paid by the city under its street lighting contracts with the Union Electric Light & Power Company. The plans were also placed before the executive committee of the Union Electric Light & Power Company, since it was to undertake the installation.

As soon as these details were determined upon, the question of cost was taken up, and it was estimated that the new lamp standards could be manufactured and installed on the streets at a total cost to the property owners and merchants of $30,000. In order to obtain this sum, the officers of the lighting association made an assessment of $1 per front foot against all of the property fronting on the streets to be illuminated by this system. The response received from the property owners to the calls for the funds was more than gratifying, showing that the

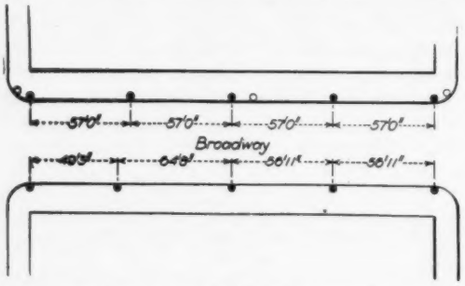


FIG. 4.—PLAN OF BLOCK LIGHTING.

movement for a new street-lighting system in the business district of St. Louis was a popular one.

Actual construction work on the new system was begun in August, and every effort was made by the Union Electric Light & Power Company to have as many streets as possible completed in time for the Centennial Celebration, which began on Oct. 4. On that date, enough work was completed to show what the entire system would be like when installed.

The district illuminated by the new system is bounded by Fourth Street on the east, Twelfth Street on the west, Washington Avenue on the north, and Market Street on the south, comprising a total of 48 square blocks.

Prior to the installation of the new system there were in this district only 138 arc lamps of the old enclosed type, which had been installed 10 years previous. Under the plan of the Down Town Lighting Asociation there are being installed within this district 437 6.8-amp General Electric magnetite lamps. These are placed in a uniform manner on all of the streets in the district, with the exception of Broadway. This street was not included in the general lighting scheme, but was left to the City Improvement Association, composed of property owners and merchants on Broadway. This asociation installed on this street 240 4-amp General Electric magnetite lamps, the maintenance of which is paid for by this association.

The plan of the Down Town Lighting Association calls for

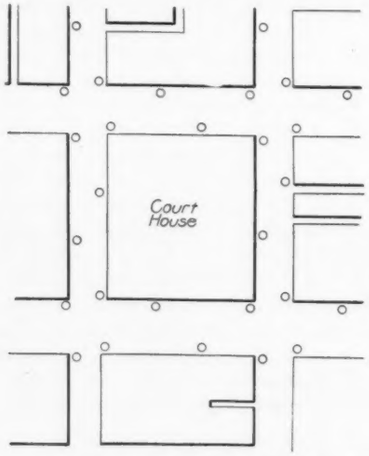


FIG. 5.—DIAGRAM SHOWING POSITIONS OF POSTS.

four lamps at each street intersection, one on each corner and so arranged that two will line up with those on the north and south streets and two with those on the east and west streets. In addition, there are placed two lamps in the middle of the block, so arranged that they are approximately 80 ft. between centers. This arrangement gives a total of six lamps per block.

On Broadway the lamp standards are designed to carry three 4-amp magnetite lamps; the standards are placed opposite each other on both sides of the street, and are on approximately 60-ft. centers. This plan gives a total of 10 standards, or 30 arc lamps per block. The effect of this illumination is exceedingly brilliant, and has transformed the dark Broadway of old days into what is believed to be the most brilliantly lighted thoroughfare in America, if not in the world.

To indicate the magnitude of the new system, it might be mentioned that in the down-town business district there will be installed, when the system is completed, 667 magnetite lamps, of which 427 are 6.8-amp and 240 are 4-amp lamps. There are 14 streets illuminated by the single-lamp and one by the triple-lamp standards. In all, five miles of streets are illuminated.

The cost to the property owners in the district, outside of Broadway, was $30,000, and the installation on Broadway amounted to $10,000. The city having agreed to maintain all of the lamps, excepting those on Broadway, the additional cost to it will be $30,000 per year, to be paid out of the general funds of the city, while on Broadway, where the maintenance is borne by the merchants, the cost is about $9,000 per year.

In order to supply the energy for the new magnetite lamps, the Union Electric Light & Power Company has installed in its station at Tenth and St. Charles Streets, three 75-lamp, 4 amp General Electric mercury-arc rectifiers and regulators, and seven 75-lamp, 6.8-amp rectifiers. Moreover, it has installed additional generators. The company has also, at its own cost, done all of the installation of the new system and has furnished all of the new lamps, the only thing paid for by the property owners in the district being the new ornamental lamp standards. When finally completed the total cost of new equipment and construction, as estimated by Mr. S. B. Way, superintendent of the electrical department of the Union Company, will be fully $100,000, thus making the total cost of the system to the property owners and the Union Electric Light & Power Company in the neighborhood of $140,000.

This new system is permanent and will be in charge of Harry S. Sanderson, supervisor of city lighting.

INTERIOR WIRING AND ILLUMINATION

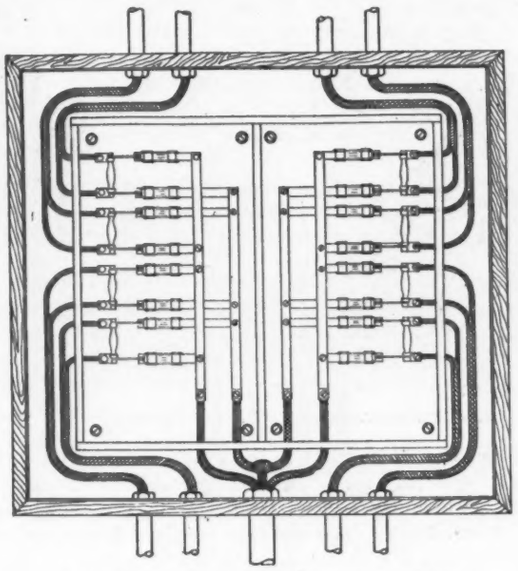
Spectacular Lighting in Denver.

Manhattan Beach, one of Denver's older amusement parks, is about to rehabilitate itself. The grounds and buildings are to be entirely rewired and some very striking illuminating schemes are projected. The rivalry in lighting of Denver's amusement parks has been very keen, as the bulk of business follows largely the adoption of improved lighting effects.

The outline wiring which was decided upon some time ago for the Denver Auditorium is now proceeding rapidly. The columns are emphasized by double rows of lights, the dome by lights outlining the arched ribs. The outlining, some 5000 lights in all, is thoroughly in accordance with Denver's new electrical ordinance. All feeders are in rigid conduit, and circuits are limited to 70 4-cp lamps, reckoning 4.8 watts per candle. The circuits employ screw-type sign receptacles in the cover of a complete metal runway of 24-gage galvanized iron. The entire arrangement is completely water and fireproof, and makes the structure a beautiful spectacle at night.

Arrangement of Three-Wire Cabinets.

Under the old rules of the National Board of Fire Underwriters covering inside work, it was required that wires must be so arranged that under no circumstances would there be a difference of potential of over 300 volts between any bare metal parts in any distributing switch or cut-out cabinet or equivalent center of distribution. This rule was not intended to prohibit the placing of switches or single-pole cut-outs for motor systems of voltages above 300 in cabinets, but required that the cabinets be divided by approved barriers, so arranged that no one section should contain more than one switch or more than one single-pole cut-out. The rule and note were stricken from the Code at the annual meeting in 1908, but provision was made in the rules governing the construction of panel boards, used for the control of lamp and motor circuits, for spacings between bare live-metal parts (busbars, etc.) so that barriers



ARRANGEMENT OF 240-480-VOLT CABINET.

would be unnecessary where the specified spacings were followed.

However, in panel boards of special design, in which the insulation separation between busbars and between other current-carrying parts is secured by means of barriers or insulating materials, instead of by the spacings specified, the cabinet must be submitted for examination and approval before being used.

The cabinet, which is illustrated herewith, shows an arrangement of 240-480-volt panels approved by the Canadian Fire Underwriters' Association. In this panel the three-wire main is divided so that only the 240-volt side of the circuit will enter any one cabinet. This arrangement conforms strictly with Rule 24a of the old edition of the Code, and illustrates what would be considered as an approved cabinet under the new rules governing the construction of panel boards in which the insulation separation between busbars is secured by means of barriers instead of by the required spacings.

Special Lighting with Posts in a Town of Six Thousand.

The two accompanying engravings show night and day views of Broadway in Albert Lea, Minn., a town of about 6000 population, where a system of special lighting has recently been installed for the principal business street. This installation is of special significance as indicating that permanent artistic lamp-post installations with underground supply are now within the reach of small towns, and that they are not necessarily confined to the large cities.

About six blocks of street have been equipped in this way. In that distance there are 50 of the three-lamp posts. The posts are of an inexpensive design, made by George Cutter, of South Bend, Ind. Each of the side arms of the post has a 60-watt tungsten lamp, and the top globe employs a 40-watt lamp.

One of the 60-watt lamps burns all night. The other two burn

until midnight. The wiring for this system is underground. A 1-in. iron conduit was installed under the curb. Branches from this line are taken under the stores to the Albert Lea Light & Power Company's pole lines, which are located in the alley. There is one switch for each block on one of the poles. Switching is done by one of the police officers. All of the tungsten lamps burn tip down, and are installed in Cutter spring sockets. The cost of installation, exclusive of taking up and putting down sidewalks, amounted to $60 per post.

FIG. 1.—VIEW OF A STREET IN ALBERT LEA SHOWING POSTS.

The company has made a five-year contract with the city, and the lighting is paid for out of the general lighting fund of the city. This in many ways is preferable to collecting from individual merchants. The company receives $45.10 per annum per post, which is considered a low rate, but the company does not figure to make much profit on the installation, as it looks for new business in window and outline lighting on account of the better illumination and greater attractiveness of the downtown streets. The installation has created considerable favorable comment in the vicinity of Albert Lea. On the opening night a band was secured by the company to play on the streets, and there were several hundred visitors from out of town to attend the celebration. The merchants did some special lighting on this occasion and gave away souvenirs. People came from as far as 100 miles to attend the festivities. Both the general public and the company feel that this lighting will boost the town considerably. We are indebted to Mr. Ludwig

FIG. 2.—NIGHT VIEW OF AN ALBERT LEA STREET.

Kemper, the enterprising treasurer and manager of the Albert Lea Light & Power Company, for the illustrations shown herewith.

The Portola Festival at San Francisco.

The festival which was held in San Francisco Oct. 19-23, in commemoration of the discovery of San Francisco Bay by Don Gaspar de Portola, and also to mark the noteworthy rehabilitation and rebuilding of the city since the fire of three years ago, passed into history as one of the greatest events of its kind ever held in the western part of the country. Many who had witnessed the Hudson-Fulton celebration in New York City, and the Mardi Gras celebration of New Orleans were under the impression that these were both surpassed by the San Francisco carnival. From the arrival of Don Gaspar through the Golden Gate on the morning of the nineteenth until the closing of the celebration there was a continuous chain of events, which drew to the city vast multitudes of people.

The electrical iluminations of the city were carried out on a larger scale than had ever before been projected on the Pacific Coast. Starting with the Ferry Building, which was itself very well outlined with lamps, a large court of honor festooned with incandescent lamps led to Market Street, which was bedecked with festoons as far as Van Ness Avenue. Third Street, from Market to the Southern Pacific Depot, and the

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FIG. 1.—NIGHT VIEW OF UNION SQUARE AND ST. FRANCIS HOTEL.

principal streets of the retail district north of Market Street, were similarly festooned with incandescent lamps. The chief

FIG. 2.—SUSPENDED BELL OF ELECTRIC LIGHTS.

electric display consisted of an immense bell containing 2000 lamps located on Market Street at the intersection of Third and Kearney. The bell was 120 ft. high, the top piece consisting of a wooden platform 8 ft. in diameter, from which the streams of colored incandescent lamps drooped to the rim of the bell that reached to the sides of the street, and itself was 40 ft. above the pavement.

The festoons on Market Street were made up of 41 16-cp lamps, and were strung from ½-in. steel cables attached to the buildings on either side of the street. Over 8000 lamps were thus used on Market Street alone. Union Square, where the bandstand was erected, was brilliantly illuminated by 1250 lamps spaced 18 in. on centers. The total number of lamps contracted for during the festival was over 30,000, and the work was executed by the Central Electric Company, although part of it was sublet to other contractors. The general illumination of the principal buildings was also well carried out, the St. Francis Hotel being the most elaborately decorated. Sixteen flaming

arcs in the tower of the *Call* Building served as the most brilliant single lighting feature.

An electrical parade on the last night of the carnival proved quite an innovation to San Francisco. Seven large floats mounted on railway trucks, and operated over the tracks of the United Railroads on Market Street, and after the parade stationed at different points on the thoroughfare, formed the most interesting features. The floats were elaborately planned, and the effect produced by them was remarkable. The most conspicuous one was emblematical of the Yosemite. On one side was the Yosemite Falls, while on the other were the Nevada and Vernal Falls, all meeting in the center and forming the Merced River. Water flowed over the falls at the rate of 1500 gal. a minute, pumped from a tank underneath by a 20-hp motor. About 1200 lamps were used to decorate the float, in addition to two search lamps. A similar float depicted Shasta and Moss Brae Falls, while on another was operated an electric fountain. All the floats were constructed at one of the barns of the United Railroads, and represented an expenditure of nearly $20,000. Mr. Otto F. Schiller was the chief engineer of the festival committee and planned most of the electrical features, while Mr. Stanley Hiller directed the electrical work in person.

FIG. 3.—MAIN ENTRANCE OF HOTEL ST. FRANCIS.

The Illumination of the New Building of the Denver Gas & Electric Company.

BY G. E. WILLIAMSON.

The new 10-story building of the Denver Gas & Electric Company, now in process of construction, will be the crowning glory of the "City of Lights" idea, started by the president of the company, Mr. Henry L. Doherty, a few years after he took up the work of reorganizing the Denver company.

In the early days of the campaign which was made by the Denver Gas & Electric Company for better lighted streets and more extensive display lighting there were those who looked with disfavor and considerable skepticism on the artistic sentiments expressed by the president with regard to advertising Denver as a "City of Lights." Early and late, in speeches and through the press, he advocated liberal lighting as a municipal feature that would not only attract tourists to Denver, but would be a powerful means of bringing new residents to the city.

The opposition to the lighting scheme argued that if the city went to the expense of putting in new street-lighting systems the taxes would become burdensome, and that in any event no good could come from such a lavish expenditure. Some business men said that private display lighting was an extravagance and would tend to make the city look "circusy." In a speech before the Chamber of Commerce, Mr. Doherty recalled to his audience the pronounced success scored by the St. Louis Exposition and very vividly and plainly showed that the decorative lighting at the Exposition was largely responsible for its popularity. He said that the way people raved about the scenic effects of the lighting at the Fair very forcibly demonstrated that it was something that was pleasing to the people, and that lighting effects on a smaller scale in municipalities would be met with as much favor as was evidenced at the Fair. The seed was well sown in that address, which was widely and favorably commented on by all newspapers in Denver, regardless of political faith, and a short time thereafter the lighting movement was well launched, and since then no one has doubted its successful outcome. The three principal streets of the business section of the city have public lighting systems, which are as artistic, if not more so, than one can find in any other city in the country. It is established beyond question that the private lighting per capita is greater than in any other municipality.

When the plans for the structure were first taken up the illuminating engineers were instructed to draw up plans which would insure exterior lighting of such rich design as would eclipse the illumination of any building in the country. He impressed on them the idea that Denver citizens would expect something of an unusual and extraordinary character in the lighting of the building, and that every effort should be made to meet their expectations. It was not a difficult matter to arrange the lighting for the splendid effects, as the architectural lines permit of an artistic placement of lamps. The face of the building will be of glazed terra cotta, which will provide the most effective and most beautiful reflecting surface. From sidewalk to crown there will not be a dark spot in the entire area of the building as viewed from any point in the city. Every inch of the surface will be illuminated. Beginning at the plane of the sidewalk, the bulkhead windows will be well illuminated with 25-watt tungsten lamps in reflectors. The windows on the first floor are to be lighted with two 250-watt tungsten lamps to each pane of glass, or a total of 8000 cp on the two street fronts.

ILLUMINATION OF DENVER BUILDING.

The exterior decorative lighting begins just below the second floor, where there will be one 250-watt tungsten lamp in an oriental lantern on each vertical column. On the 24-in. lintel, just above the large windows, there will be a changeable letter

electric sign, extending along Fifteenth and Champa streets, which will be used for changeable advertisements each week. On the panels between windows on the second floor will be a cluster of 48-cp and 32-cp tungsten lamps, with an outline of 20 10-volt, 4-cp tungsten lamps forming a frame around the center cluster. Lining the cornice above the second floor 48-cp tungsten lamps will be used about 6 ft. apart. The entire field between the second story and the eighth story will be dotted with 4-cp tungsten lamps, set in a diadem design at regular intervals between windows. These lamps are studded in terra-cotta rosettes and set back until only one-third of the lamp protrudes, thereby heightening the daylight appearance of the scheme. This plan is applied to all the smaller lamps. In the belt course at the ninth floor level is a row of 32-cp tungsten lamps, about 2 ft. apart, and at each panel between windows in the cartouches, extending in a tapering form downward, is a row of lamps, beginning with a 4-cp tungsten lamp at the point, then a 25-watt, a 40-watt, a 60-watt, and finally three 60-watt lamps in a panel 30 in. long and 10 in. wide at the top.

The two top stories and cornices are designed to develop a most striking crown of illumination. Small lamps are used in great numbers close together to emphasize the lines of the architecture. The cornice is coved to act as a reflector to throw the light downward from the numerous lamps. The ornamental pilasters of glazed terra-cotta will be effectively illuminated by vertical rows of lamps studded thickly between them. In the cornice design over the windows, in the center of each cluster, there will be a 200-cp lamp set behind a bull's-eye lens, a reflecting surface being behind the lamp. Below these clusters in the center of panels between windows the same diadem arrangement of lamps as on the second story will be used.

At the top of the cornice line of the building, extending in a continuous row in the cheneau, will be a line of 80-cp lamps, 3 ft. apart, set behind bull's-eye lens or frosted plate glass. In order to take away any offensive glare from the high-candle-power lamps, and to insure a beautiful diffusion, each large lamp installed will be placed behind frosted plate glass, which will be held in place by a hinged copper collar. A large animated electric sign of several thousand lamps will complete the exterior lighting scheme. From time to time, as occasions suggest, the color of the lamps will be changed. The white terra-cotta finish of the building will make it easy to produce a red or green glow over the entire structure, and such spectacular lighting, towering high in the blackness of night, will make a most sublime picture. It is the intention of the light company to keep a lamp lighted in each outside room until midnight, so that the illumination will in no way be marred by dark windows. The elaborateness of the above lighting scheme can be imagined when it is known that approximately 61,000 cp will be required to complete it.

The main features of the building were designed by the Edbrooke Architect Company, according to suggestions from President Doherty and General Manager Frueauff, of the Denver Gas & Electric Company. The lighting arrangements were devised by the latter company, the work being intrusted to its illuminating engineers, Messrs. G. E. Williamson and C. F. Oehlmann.

Letters to the Editor.

The Patent System and Its Relation to Industrial Development.

To the Editor of Electrical World:

Sir:—The prevailing dissatisfaction among inventors and certain classes of manufacturers with the present patent laws, and the unfavorable commercial conditions arising therefrom, have led to many expressions of opinion and suggestions in technical journals and elsewhere. The fundamental causes, however, have usually been lost sight of, and it is the purpose of this letter to touch on some of these; and as presenting the best arguments yet offered in support of the existing patent situation, reference will be made to the paper presented earlier in the year before the American Institute of Electrical Engineers by a distinguished lawyer who has figured as attorney or counsel in some of the celebrated patent cases of the past 20 years.

Among the suggestions made in the discussion of this paper was one to leave changes in patent law to the courts, notwithstanding that the Constitution expressly charges this work on Congress. It also appears to be a mistake to think that "slowness" is a safe means to reach the desired end, in view of the abuses that have developed in the present patent system, and which require the earliest possible correction. Our present patent laws were made sporadically, and as a consequence there is no system or order about them. There is no bureau or commission as in European Governments to keep watch on such of our laws, like those relating to patents, as do not directly enter politics. Patent laws require special means for their intelligent preparation, based on statistics bearing on the prevailing economic conditions. Such statistics should be accessible to Congress at all times, and changes should be proposed to Congress by an institution of this sort of its own creation. It should not take the form of class legislation, such as bills prepared by the American Bar Association, and it should not take 6, 10 or 20 years to obtain a needed change. For many years the circuit courts have handled patent suits, but there has never yet been any pronouncement from this source as to whether our present patent system is detrimental to industrial development, to the manufacturing interests or to the citizens at large.

Following are some examples that point to the desirability of patent reform:

A manufacturer "A" has proved in one Circuit Court that the patent of another firm "B" is invalid, being entirely anticipated by the prior art. The Circuit Court renders its decision in favor of "A." "A" makes shipments of the article involved in the suit to agencies in different parts of the country, and later is informed by "B" that suits in several other circuits are started. If "A" cannot produce the money to defend himself in these other courts, he has to surrender to his opponent and stop the sale of the article, although the law is on his side. For this reason alone, if no other existed, it is wrong to have cases national in their scope passed upon by a court of less than national jurisdiction.

A young man received a grant of a patent, which, after its publication, a large corporation thought to be in its way, although the company had devices almost as good; a patent application was therefore filed in Washington for the same device and with the same claims, which resulted in interference proceedings. The young man stood up for his rights, paid the expenses incidental to such suits, and was gratified by a just verdict from the Patent Office, having established beyond doubt that he was the prior inventor. Did the company buy the patent? No. Did it approach the man with an offer? No; but within two years that company used the device anyhow. Here it is—the law, the Patent Office, is on the side of the inventor, but he is too small to be considered of any consequence by those affected by his patent grant.

In another case an inventor saw his manufacturing processes used by several firms, who paid no attention to his rights or claims, and was unable to stop the practice. When later these patents were acquired by one of the strongest firms in this country, a letter was sent to each of the offenders, and without recourse to any court the wrongful practice immediately stopped.

One ambitious concern has set itself the task of controlling an immense and profitable industry, and has succeeded in doing so, as follows: It hired inventors and mechanics to improve the machines on the market used in this industry and to design additional ones needed for special operations. After a fairly complete line had been produced, it went to the manufacturers of the product involved and showed them how much better and quicker their work could be done with these improved machines. As a further inducement, the manufacturer was not to buy the apparatus at all, but merely pay a royalty for its use; and

to be equitable and really kind to the manufacturer, the concern did not even ask a fixed royalty, but based the compensation on the output of the machines. In this way small concerns or beginners were not frightened by fixed charges. So far everything looks rosy. People could start in this line without paying a cent for their factory full of special machinery, and many availed themselves of the opportunity. Gradually, the independent manufacturers of special machines not covering all operations found themselves crowded out of the market. In due time, the first-named firm, after having gained considerable strength, requested its customers to give them preference when needing any new machine for specific work, as it was willing to furnish all the machinery that was required in the industry. When competition practically ceased, the former requests, however, became demands, and were incorporated in the contracts. Here, then, is an industry of which the independent inventor finds all the doors closed to him. He cannot sell a patent unless the trust wishes to buy it, nor sell a machine after he has built it. Here is an industry controlled indefinitely, first through patents, and later without them. The manufacturer now feels he is powerless against this trust, and realizes that while he is supposed to be a free American, he is in fact a mere industrial serf, and moreover has to pay per year a royalty equal to or twice the price of a machine. He must not complain, however, for if he did the company would withdraw its machinery and he would be without a business. And to what tribunal could he complain if he wished? The courts are not the place to make a complaint of wrong economic conditions; and under present laws neither the royalty system nor the form of contract used contains anything illegal.

In spite of the inflexibility of our patent laws, in spite of the difficulty met with in the introduction of reforms or bills before Congress and years of labor and waiting in the realization of any measure, members of the American Institute of Electrical Engineers are told in the paper above referred to of the great benefit brought about by our present patent system, though inventors as a body and smaller manufacturers bitterly resent the injustice which it works; that the American patent is an exclusive grant for 17 years, when everybody knows who has had any dealings with patents that it is far from being so with respect to the great majority of inventors; and that in the distribution of profits of inventions as between the capitalist, the business man and the inventor, the last mentioned secures "on the average, as large a portion to which he would be entitled under ideal conditions (such as never can be attained) as come to any other workman in our vast industrial army." That the laws are inadequate in many particulars is not pointed out, nor reference made to the conditions arising from enormous commercial industrial development and modern business methods, whereby the rights of individuals and of the financially weak can be overridden in a manner never dreamed of when the laws were enacted.

Trusts and monopolies have come to stay, and we should not be antagonistic to them. This letter is not written with any intention of charging bad faith against the courts, patent attorneys, the Patent Office, Congress nor the large commercial interests. Its purpose is to call attention to basic defects in our patent system, the correction of which must be made to render the superstructure sound. We must look to Congress to improve systematically our patent laws. That body should not give to some few the opportunity of subverting such laws to their own interests. It should create a department representing the people, whose duty it shall be to consider patent laws and their needed changes, to accumulate statistical data, receive complaints, and take account of court decisions, etc., to the end that Congress may obtain an insight into the good or bad effects of a law on commerce or on the people, and to make suggestions and propose bills to enable the swift removal of detrimental laws. The passing of bills presented by any one class of people, such as is represented by the American Bar Association, may be of benefit to the specific class of petitioners, but is not likely to be of benefit to the engineer, to the inventor, to the manufacturer or to commerce in general.

One of the attorneys who participated in the A. I. E. E. discussion almost hit the nail on the head when he ascribed the prevailing discontent as due to patentees or patent owners *who have failed to enforce rights,* because, as a matter of fact, they did not have any rights to enforce. The discontent is, however, not with the man who finds that his patent is of no value, but with the man who finds that it takes all his means to enforce the rights to which he is entitled, against those who would wrongfully profit by an invention of which they recognize the value. In this country the "law" alone does not protect or help to get what is one's due. *You* have to *enforce* your rights, and it takes money, experts, lawyers, etc., to do so in these days. Municipal ordinances would be of no value unless there were a police force behind them; and, similarly, commercial rights are comparatively valueless unless a means is created for patent law supervision and investigation on the order of the Interstate Railway Commission, a bureau where just causes can be filed, and if they are found to involve a principle laid down by the Constitution, or affecting the rights of the people, the Patent Office surplus fund, or some other fund, should be available to cover the cost of investigation and enforcement of the law applying. Millions that could be used in trade expansion are now tied up as reserves for legal expenses in companies, or in factories not properly worked, due to pending suits with no hope of a decision within two, four or more years.

During the A. I. E. E. discussion a past-president of the body made the suggestion that "the board of directors of the A. I. E. E. should appoint a committee to investigate and report upon what reforms in our patent system are desirable, and how they may be best brought about," which suggestion has not, we believe, been acted upon. In this connection the writer may say that almost two years ago he asked the board to take action on the following resolution: *"Whereas,* it has been found that our patent laws are inadequate for present needs; *and whereas* they are the cause, to a considerable extent, of hardship and losses to manufacturers and individuals; *Be it resolved,* that we, the American Institute of Electrical Engineers, herewith express our sympathy with the present movement and with any step taken that will bring this matter before the proper department of our national government and legislative bodies for their consideration and action." After some time, in substance, the following reply was received: "Your letter was referred to the law committee of the Institute, which reported back to the board of directors on Nov. 13, 1908, advising that the general feeling of the law committee was that it was beyond the scope and object of the work of the Institute, as outlined in its constitution. The board of directors accepted the report of the law committee."

In passing, attention may be directed to the anomaly of an apparently dominating legal influence in a body nominally representing a profession and an engineering science, a body which should consider questions brought before it in a manner consonant with professional propriety and with the scientific spirit in which its members are trained. It may also be remarked that the definition of the narrow scope of the Institute is not in accordance with the action of that body several years ago at the Asheville convention, when it appointed a committee on forest preservation, nor with the resolution adopted by the board of directors in January, 1908, which concluded as follows: *"Be it resolved,* that the committee of forest preservation be instructed to communicate the resolution to all members of Congress and to the Governors of all the States"—a resolution, by the way, that was uncalled for and unnecessary as it was passed long after President Roosevelt and public-spirited engineers acting individually had created sentiment which made forest preservation a matter of public policy.

It is doubtful whether any society that claims to be representative of a profession and art and to be national in scope and influence can ignore questions brought to its attention vitally affecting both its members and the art for which it stands, without curtailing its specific usefulness, its reputation and its influence with the public at large.

Concerted action by societies is necessary to bring matters of such professional moment before Congress. Inaction with respect to situations vitally influencing the welfare of those who by their original work further the science and the industry is a

short-sighted policy. Action is required which will lead to the establishment of an office or commission, with necessary authority, accessible at all times to the people, and, as a source of information to Congress. Without supervision of some sort we shall drift more and more toward industrial serfdom, and our present patent system, as shown by examples which can readily be multiplied, is one of the powerful curents in that direction.

St. Louis, Mo. Ludwig Gutmann.

Characteristics of the "Spinner" Motor.

To the Editor of Electrical World:

Sir:—The description given by Mr. Selby Haar in your issue for Sept. 16 of the performance of the "spinner" motor is generally accurate except in that case where the number of poles in the stator is smaller than the number of poles in the spinner winding. Since one would naturally place the larger number of poles on the element of larger diameter, this case is of relatively small importance. However, it may be well to call attention to the actual operation in the case stated.

Imagine, as does Mr. Haar, that the spinner being connected to the mains has run up to nearly the synchronous speed corresponding to the larger number of poles, and assume that it is running counter-clockwise. If voltage is now impressed upon the stator winding, the rotor will be accelerated up to nearly the synchronous speed due to the smaller number of poles and the field will, therefore, have a velocity in space equal approximately to the difference between the synchronous speeds of the stator and the spinner. The rotor will tend to follow this field and will, therefore, rotate counter-clockwise with a speed approximately equal to that of this field. The conditions then prevailing between the spinner and the rotor will be exactly those of an induction motor run with negative slip; that is, when it is acting as a generator. The spinner will return energy to the line, but it is a mistake to say that the machine will be inoperative; on the contrary, the rotor will continue to run at a speed approaching the synchronous speed due to a number of poles equal to the stator poles plus the spinner poles.

It is well known that in the case of an ordinary alternator when the field magnets are driven, the armature, if free to rotate, will tend to follow the field, and this is exactly the action that takes place in the spinner motor. It is difficult to understand what Mr. Haar means by the machine being inoperative; he himself states that the rotor will tend to follow the magnetic field. Since there is nothing to counteract this tendency the rotor will continue following the field, slipping just sufficiently to allow circulating in its windings such a current as will produce a torque equal to that of the load. If, on the other hand, it were possible to make the rotor run rather faster than the magnetic field, the currents generated would be such as to retard the rotor, which must, therefore, immediately drop back to a speed slightly less than that of the field.

It appears from the above that the case when the stator is wound with the smaller number of poles is exactly similar to that when the spinner has the smaller number; in either case when the current is in such a direction as to give the lowest of the three possible rotor speeds, that element having the larger number of poles becomes a generator and returns energy to the circuit, while the other element takes from the circuit a supply of energy sufficient to account not only for the work done, but also the energy returned by the other element and all the losses.

Glasgow, Scotland. W. B. Hird.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Alternating-Current Motors.—G. Kapp.—In his presidential address to the (British) Institution of Electrical Engineers, the author gave a review of various new developments in alternating-current motors. He referred to the induction motor of Hunt, who by a new method of grouping the coils has adapted the cascade principle to one motor only. He is thus able to run an eight-pole motor at the speed of a 12-pole motor while getting a better power factor than is possible with the orthodox way of using two motors in tandem. The system of speed regulation of Aichele and Brown-Boveri for three-phase motors was also referred to. This motor has been applied in the latest Simplon locomotives. The rotor is simply a squirrel-cage, and has no slip-rings and no outside electrical connections whatever. The bars are ventilated copper tubes, and the end connections are designed to withstand a temperature of from 200 deg. C. to 250 deg. C., when an exceptionally large starting current is developed. The stator has two distinct windings, one for 16 poles and the other for 12 poles, and each winding can, by means of a pole changer, be so grouped as to produce half its normal number of poles. (A detailed description by J. Collignon of this motor and of the Simplon locomotives is given in *La Houille Blanche,* November.) An improvement in single-phase motors has been devised by Deri, and practically developed by the Brown-Boveri Company. Two sets of brushes are employed, one being fixed in the polar axis of the stator and the other so adjustable as to include different angles with the fixed brushes. The effect of shifting the brushes is analogous to changing the impressed voltage on an ordinary direct-current series motor, and thus, by adjusting the brushes, the torque and speed may be regulated. This property renders the Deri motor valuable in all cases where delicate speed regulation is essential. It is largely used for working passenger elevators and other hoisting machinery, and also for driving ring spinning frames, the speed regulation in the latter case being automatic. Another application is for electric railway working. The Winter-Eichberg motor as first developed for railway work had a series characteristic; recently Eichberg has altered the winding so as to give the motor a shunt characteristic, so that it runs at constant speed whatever the load is within its range. The motor is started as a series machine, and

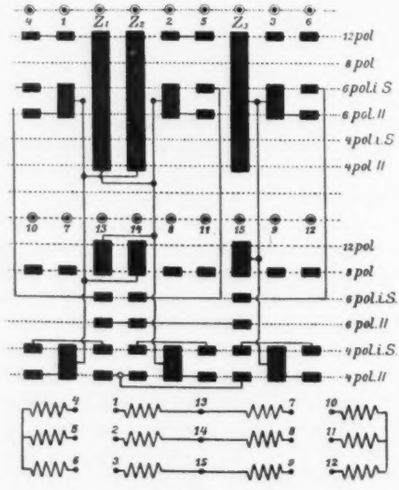


FIG. I.—DIAGRAM OF CONNECTIONS.

when up to speed, or nearly so, it is switched over by its controller to the shunt condition. The power factor is very nearly unity at all loads.—Lond. *Electrician,* Nov. 19.

Speed Regulation of Induction Motors.—An illustrated description of various methods of the Oerlikon Company for regulating the speed of induction motors by varying the num-

ber of poles. For two speeds use is made of one drum winding by means of which two numbers of poles in the ratio of one-to-two can be obtained. For four speeds there are two such drum windings in the stator, which can be connected as shown in Fig. 1. The diagram shows all possible connections. If the motor is to be used for constant torque, the first, second, fourth and sixth connections (counted from top to bottom) are used. If the motor is to be used for constant power, the first, second, third and fifth connections are employed. Six speeds can be obtained by means of two drum windings, each of which permits the production of three numbers of poles.—*Schweitz. Bauzeit.*, Vol. 54, 1909, page 170; abstracted in *Elek. Zeit.*, Nov. 18.

Stator Winding.—J. BÜCHI.—The author points out that the use of high speeds for alternators when driven by steam turbines has caused a considerable change in the design of stator windings. Some numerical figures are given.—*Elek. und Masch.* (Vienna), Nov. 14.

Testing Machinery.—E. F. COLLINS.—In a continuation of his illustrated article on commercial electric testing, he deals especially with core-loss tests. Field compounding tests and maximum output tests are also referred to.—*Gen. Elec. Review*, December.

Voltage Variation.—E. PLACE.—An illustrated description of a graphical method for predetermining the voltage variation in direct-current machines. Both shunt generators and compound generators are discussed.—*Gen. Elec. Review*, December.

Lamps and Lighting.

Metallic-Filament Lamps for 220 Volts.—EINBERGER.—An account of tests of 220-volt metallic-filament lamps. In spite of the difficulties involved in their manufacture, the results are quite satisfactory. In life tests of 50 lamps, furnished by 10 companies, tested on a circuit the e.m.f. of which varied between 216 volts and 225 volts, nine lamps were still burning after 3100 hours. These nine lamps were made by three different companies. Almost all of the lamps of two of these companies had a life of more than 2000 hours. Only two types of lamps had a life of less than 500 hours. The specific power consumption varied between 0.97 watt and 1.47 watts per hefner candle. Blackening in the globe was observed with several types of lamps. The 220-volt lamps are more sensitive with respect to vibrations than are the 110-volt lamps.—*Zeit. d. Ver. Deutsch. Ing.*, Vol. 53, 1909, page 1587; abstracted in *Elek. Zeit.*, Nov. 18.

Metallic Filaments.—A note on a recent British patent of W. Heinrich (7092, 1909; Nov. 11, 1909). A binding agent for forming filaments without carbon, comprises five parts of pure sulphur and six parts of dry amorphous phosphorus. The mixture is heated, and at 2000 deg. C. a dark liquid is obtained. Three parts of this liquid are mixed with 15 parts of tungsten or other metal powder, and the product is squirted into filaments. The greater part of the binding agent is removed by heating the filaments in a vacuum at 450 deg. C., but there is formed a metal phosphide or sulphide which holds the filament together until it is sintered. This last process is carried out in a vacuum, at 1000 deg. C., or more, and the sulphide and phosphide are reduced, leaving pure metal.—Lond. *Elec. Eng'ing*, Nov. 18.

Generation, Transmission and Distribution.

Electric Cranes.—H. H. BROUGHTON.—A continuation of his long illustrated serial. The author begins to discuss several of the problems entering into the design of the slewing mechanism. The method of determining the size of the motor, when the several resistances are allowed for, is described; and the design of the roller bearings is considered at some length. Typical examples by leading British and German firms are given of slewing mechanisms, roller and footstep bearings, pressure rings, pillar bearings and turntables.—Lond. *Electrician*, Nov. 19.

Steam Turbines.—A. CEYTRE.—In a continuation of his illustrated article on steam turbines the author deals with the De Laval turbine.—*L'Industrie Elec.*, Nov. 10.

Electricity in Harbor.—O. HEINISCH.—An illustrated article on electricity supply in the Ruhrort harbor and its electric equipment. The article, which is profusely illustrated, is to be concluded.—*Elek. Zeit.*, Nov. 18.

Traction.

Single-Phase Traction on Midland Railway.—J. DALZIEL AND J. SAYERS.—The first of three papers on electric traction presented at a recent meeting of the (British) Institution of Civil Engineers. This paper deals with single-phase traction on the Heysham-Morecambe-Lancaster section of the Midland Railway. The paper sets out the disabilities under which it has been variously alleged single-phase apparatus labors—particularly in respect to its asserted unsuitablity for high-schedule speed, frequent-stop, suburban and interurban traffic, necessitating high accelerations, and attempts to prove from the results of special tests, made with a view to ascertaining the accelerating capabilities of the Heysham equipments, that single-phase apparatus is not only equally as capable of working such services as is direct-current apparatus, but that the weight of the single-phase trains is only a very small percentage greater than that of corresponding direct-current trains, and that the energy consumption is appreciably less.—Lond. *Electrician*, Nov. 19; Lond. *Elec. Eng'ing*, Nov. 18.

Electric Versus Steam Traction.—J. SHAW.—This is the second paper of the three electric traction papers at the recent meeting of the (British) Institution of Civil Engineers. The author gives a comparison of the equipment and working results of the Mersey Railway when worked by steam and by electricity. In order to make a comparison between the working results of the railway when operated by steam and electricity, three years' working results under both systems have been analyzed, and for each system an average year of steam and electricity has been arrived at. The working results are compared on the basis of total cost per year, cost per train-mile, per ton-mile and per seat-mile. The costs have been divided under various headings, which make up the total cost of the locomotive and engineering departments. The departments of a railway which are most directly affected by the substitution of electricity for steam are the locomotive and car departments, and the tabulated results show that under electric working these costs have been reduced from 0.234 cent to 0.198 cent per ton-mile. With electric traction, 1 lb. of fuel costing $2.18 per ton moves 1 ton of load 2.29 miles at an average speed of 22.25 miles per hour; whereas, with steam the same weight of fuel, costing $4 per ton, moved the same load 2.21 miles at an average speed of 17.75 miles per hour. The effect of electric traction on the maintenance of the permanent way has been to reduce the cost of maintenance per ton-mile from 0.0416 cent to 0.024 cent. As regards the life of rails under the two systems, the average rolling-load over the track before the rails require renewal is increased from 32,000,000 tons to 47,500,000 tons. The effect of electric working has been to decrease the cost per ton-mile as follows: (1) Total cost of working and maintaining the whole of the locomotive and engineering departments from 0.476 cent to 0.0250 cent, a decrease of 0.172 cent. (2) Total costs of the railway, including general charges, etc. (but exclusive of interest on additional capital for electrification) from 0.688 cent to 0.48 cent, a decrease of 0.208 cent. Summarized comparative results of the change upon the working and finances of the railway are given in three tables, which show among other things that the average speed, including stops, has been increased from 15.6 miles to 19.9 miles per hour, and the number of ton-miles per annum from 43,000,000 to 67,000,000, while the total expenses per ton-mile, after allowing interest on additional capital for electric works, have been reduced from 0.688 cent to 0.5856 cent. In the half year ending June 30, 1908, the number of passengers carried was more than twice as large as in the last half with steam working (ending Dec. 31, 1902) and more than 2.5 times as many season tickets were issued; the seat-miles run per passenger showed a decrease of 30 per cent; and the passenger receipts per seat-mile an increase of 26.5 per cent; while the ratio of expenses to receipts

decreased from 95.3 per cent to 69.8 per cent.—Lond. *Electrician,* Nov. 19; Lond. *Elec. Eng'ing,* Nov. 18.

Electric Traction on Northeastern Railway.—C. A. Harrison.—This is the third paper presented at the recent meeting of the (British) Institution of Civil Engineers. It deals with the results obtained on the electric section of the Northeastern Railway. The total length of the electrified line, including sidings, is 75 miles, and the average distance between the station stops is 1.25 miles. The current, at a pressure of 600 volts, is taken directly from the conductor rail by shoes fixed on the electric cars, the return current passing through the track rails which are bonded similarly to the conductor rail. Although the pressure is 600 volts, there has not been a fatal accident due to electric shock to any of the company's employees, and serious injury due to shock has been very exceptional, the men being provided with insulated tools, rubber gloves, and mats for their protection. Fatal accidents through shock which have occurred on the electrified lines have, in all cases, been due to trespass. The advantages obtained are increased work that can be done at the platforms of the stations, the high acceleration made possible with electric trains and the resulting saving of time, without increasing the maximum speed. The paper gives an estimate of the annual cost of renewals, and concludes by showing that it would have been impossible with the old steam service to carry the number of passengers that are now being conveyed on the Tynemouth lines with the electric service.—Lond. *Electrician,* Nov. 19, and Lond. *Elec. Eng'ing,* Nov. 18.

Electric Traction on Main Line.—Eichberg.—A note on a recent lecture in which the speaker first drew attention to the rapid way in which electrically worked tramways had been developed, compared with the comparatively slow progress made in the same direction on railways. He considered that the reason for this was that commercial advantages in railway work from the employment of electricity were only to be expected when the traffic was heavy, the gradients steep or the use of water-power possible. Another advantage obtained by the employment of electricity was the absence of smoke—a matter which had received great attention in the United States. Dealing historically with the question of electric traction on main lines, the lecturer first referred to the experiments made on the Baltimore & Ohio line in 1894, and to the use which was being made, both in New York and Paris, of electric locomotives for terminal operation. The various features of direct-current, third-rail operation, and of the three-phase and single-phase systems were also described, the great advantages of the last of these as regards simplicity being mentioned.—Lond. *Electrician,* Nov. 19.

Surface-Contact System.—An abstract of last year's financial account of the municipal traction system of Wolverhampton in England. This is specially interesting as the Lorain surface-contact system is in operation and has proved very satisfactory, although the use of this system means an isolation from surrounding tramway systems. The length of single track on which the Lorain system is in use is 20 miles, and the car mileage for the year ended March 31 last was 962,681. Since the number of passengers carried was 9,050,459, the average number of passengers per car-mile was about 9.4. The items of most interest are those of kw-hours used per car-mile and repairs and maintenance. As regards the former item, the total number of kw-hours used for traction and car lighting was 1,502,068, or 1.56 kw-hours per car-mile, which is not an excessive consumption, and is also less than the figure of 1.60 kw-hours per car-mile recorded last year. The working expenses amounted to 12.748 cents per car-mile, as against 13.018 cents per car-mile a year ago, and a reduction has been made in the cost of maintenance and repairs which now totals only 2.366 cents per car-mile. The Lorain track and car equipment (which is included in the last figure) has cost 0.486 cent per car-mile, a considerable reduction on last year's figure. The operating expenses per car-mile were 8.606 cents, the total general expenses were 1.776, repairs and maintenance 2.366, hence the total working expenses 12.748 cents. There were also in operation three motor-omnibuses which were run at a slight loss.—Lond. *Electrician,* Nov. 19.

Brake-Block Coefficients of Friction.—E. Wilson.—As the result of some tests to determine the coefficient of friction of brake blocks under different conditions, the author has found that the effect of water on the blocks is to reduce the coefficient in the case of non-metallic blocks to a dangerous degree. Cast-iron blocks showed little variation. Tests were made at different speeds and with various specific loads.—Lond. *Elec. Eng'ing,* Nov. 17.

Berlin.—E. C. Zehme.—A critical review of the existing and projected electric rapid-transit lines of Greater Berlin.—*Elek. Zeit.,* Nov. 18.

Installations, Systems and Appliances.

Electrical Industry in Great Britain.—G. Kapp.—His presidential address to the (British) Institution of Electrical Engineers. The author reviews the present position of electrical engineering, indicating the more important developments and general tendencies. Generators, transformers and motors are first considered, after which the applications of electricity to industrial developments are reviewed, namely, distribution of energy, electric railways, winding engines, rolling mills, electric steel furnaces, fixation of atmospheric nitrogen and electricity in agriculture. In conclusion, a few remarks are made in regard to the lack of prosperity in the electrical industry, and to the possibility of the Institution doing something to accelerate the introduction of electricity into the great industries. A great many detailed advances are reviewed and some figures are given on the capital invested in electrical industries in Great Britain. The figures for 1899 and the middle of 1909 are as follows: Telegraphs, $171,424,785 in 1899 and $181,415,190 in 1909; telephones, $38,648,130 and $110,663,205 respectively; electricity supply companies, $46,328,965 and $228,718,720; municipal supply stations, $41,755,835 and $258,983,020; electric traction, $104,044,795 and $925,961,480; electric manufacturing, $83,995,760 and $212,431,345; electrochemistry and miscellaneous, $42,790,325 and $61,268,110; total, $529,888,595 and $1,929,441,070 respectively.—Lond. *Electrician,* Nov. 19.

Statistics of German Central Stations.—G. Dettmar.—An article giving some further deductions from the recently published statistical tables of the central stations in Germany on

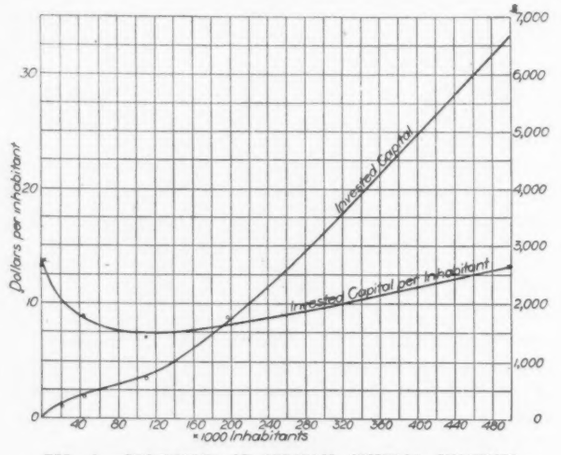


FIG. 2.—STATISTICS OF GERMAN CENTRAL STATIONS.

April 1, 1909. The author has estimated the corrections which must be applied to the figures to take into account those central stations from which no exact figures were obtained in reply to the inquiry. The corrected figures of some main items for Germany are given as follows:

Number of incandescent lamps	14,000,000
Incandescent lamps, kw	700,000
Cooking and heating apparatus, kw	50,000
Total connections, kw	1,950,000
Central station equipment, kw	1,200,000
Number of meters	675,000
Kw-hours sold	1,250,000,000
Capital invested	$287,500,000

Some interesting data concerning the capital invested are shown

in Fig. 2 and Fig. 3. The former gives the total capital invested and the capital invested per inhabitant as functions of the size of the city in thousands of inhabitants. The second diagram gives the same figures for capital invested as functions of the ratings of machines in thousands of kilowatts. During

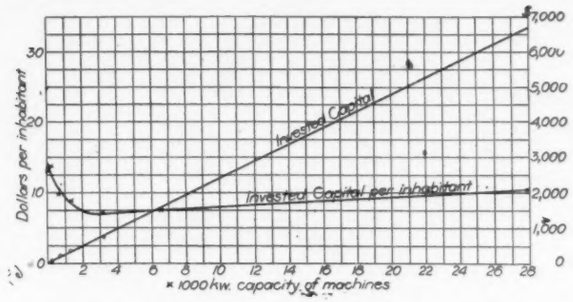


FIG. 3.—STATISTICS OF GERMAN CENTRAL STATIONS.

the last three years the erection of new central stations in Germany has been exceedingly rapid in cities having less than 1000 inhabitants. Approximately one-half of all central stations are in cities between 1000 and 5000 inhabitants. Some figures of maximum load and load-factor as functions of the size of the city are given in the following table:

Number of inhabitants in the city.	Kw-hours ÷ maximum kw.	Load-factor in per cent.	Kw-hour ÷ connections in kw.	Maximum load ÷ connections.
up to 1,000	808	19.1	288	0.36
1,001 up to 5,000	1,010	11.5	350	0.35
5,001 up to 10,000	1,265	14.4	448	0.36
10,001 up to 20,000	1,450	16.6	475	0.33
20,001 up to 50,000	1,440	16.5	430	0.30
50,001 up to 100,000	1,716	19.6	620	0.36
above 100,000	1,984	22.7	730	0.37

The first column gives the size of the city expressed in the number of inhabitants. The second column gives the total number of kw-hours sold divided by the maximum load in kilowatts. From this figure the load factor given in the third column is found. In the fourth column is given the ratio of the total kw-hours to the connections in kilowatts. The last column gives the ratio of the maximum load to the rating of the connections. The number of central stations owned by municipalities, or by the State, is 632, while the number of central stations owned by private companies is 1328.—*Elek. Zeit.*, Nov. 18.

Regulations in Austria.—The safety regulations of the Vienna Electrical Society, which had already been adopted by the Association of the Austrian and Hungarian central stations, have now also been recommended by the Government for general application.—*Elek. und Masch.* (Vienna), Nov. 14.

Protection Against Lightning Discharges.—R. SÜRING.—A report of the committee of the Berlin Electrical Society on the protection of electric installations against atmospheric discharges.—*Elek. Zeit.*, Nov. 18.

Electrophysics and Magnetism.

Striæ in a Dust Tube.—L. J. RICHMOND.—Under suitable conditions lycopodium powder placed in a glass tube arranges itself in well marked striæ under the influence of an electric discharge. The object of the author's experiments was to ascertain whether the frequency of the electrical oscillations could be ascertained from observation of the striation of the powder under their influence. From the results it appears, however, that the distance between the striations depends very little upon electrical conditions. The matter seems quite complicated.—*Phil. Magazine*, November.

Direct Current from Alternating E.M.FS.—J. VON GEITLER.—A paper in which the author gives the general theory of the production of direct current from purely periodic alternating e.m.fs. when acting in a circuit the resistance of which changes periodically. The theory is believed to contain, as special cases, the rectification of alternating current by means of "valves," and also the production of direct current in commutating generators, etc.—*Phys. Zeit.*, Nov. 10.

Fluorescence and Ionization of Mercury Vapor.—W. STEUBING.—An account of experiments which show that mercury vapor when illuminated with ultraviolet light and fluorescent is ionized. The author concludes that in addition to the negative electrons positive atoms are present.—*Phys. Zeit.*, Nov. 10.

Radium.—J. ELSTER.—The first part of a review of our present knowledge of radium and radioactivity.—*Elek. Zeit.*, Nov. 18.

Units, Measurements and Instruments.

Weston Standard Cell.—C. CHREE.—An abstract of a (British) Physical Society paper on cadmium amalgams and the Weston standard cell. Cadmium amalgams may be solid, liquid, or a mixture of solid and liquid phases, the percentage composition of the phases depending on the temperature. When a completely liquid amalgam is cooled below the lower transition temperature, the center of the resulting solid is of high cadmium concentration, and the outer skin of low cadmium concentration. Diffusion tends to produce uniformity and in consequence the e.m.f. of a cell containing the amalgam is unstable for a considerable length of time. When the amalgam is slowly cooled to a temperature a little below the lower transition temperature the difference of concentration between the inner and outer parts of the amalgam need be only small to enable the outer skin to be a two-phase system. The diffusion process will be slow and the e.m.f. may remain constant for a very long time. Amalgams which were of uniform cadmium concentration throughout were obtained by chilling completely liquid amalgams to a temperature of about —50 deg. C.; although not initially stable, rapid diffusion processes resulted in these amalgams becoming approximately uniform throughout after a few days, and their electromotive properties were markedly different from those of amalgams cooled slowly. If, however, the temperature of such an amalgam is raised until two phases exist, subsequent cooling will not restore the uniform condition, and an unstable amalgam results. The experiments indicate that a 12.5 per cent amalgam may be safely used at all temperatures between 12 deg. C and 60 deg. C., and a 10 per cent amalgam at all temperatures between 0 deg. C. and 51 deg. C. Experiments made on the temperature-voltage coefficients of the anode and cathode limbs of the Weston normal cell show that if a difference of temperature of 1 deg. C. exists an error of about 3 parts in 10,000 is introduecd.—Lond. *Electrician*, Nov. 12.

Pressure and Resistivity.—M. A. LAFAY.—A paper read before the French Academy of Science on the measurement of high pressures (mechanical pressures) by the variation of resistivity produced. The author's results of the effect of high pressures on the resistivity of platinum and of mercury have recently been noted in the Digest. Platinum would involve considerable difficulties in practical use on account of the temperature coefficient of resistivity. Mercury can be used with sufficient accuracy, but it would be simpler to use a metallic wire for the construction of a piezometric instrument. Like platinum, almost all metals have a temperature-resistance coefficient sufficiently large to act as a disturbing factor. The best metal to be used is the alloy manganin, which has a zero temperature coefficient of resistivity and which is an alloy of copper, nickel and manganese (Cu 84, Ni 1, Mn 12). The relation between the electric resistivity and the pressure is given in the equation.

$$\frac{r - r_0}{r_0} = + 2.23 \times 10^{-6} P,$$

where the pressure P is given in atmospheres.—*L'Industrie Elec.*, Nov. 10.

Selenium Cell.—A. KORN.—A mathematical discussion of the principles of his compensation method (used in his process for transmitting pictures) to reduce the inertia of selenium cells.—*Phys. Zeit.*, Nov. 10.

Wehnelt Interrupter.—P. BARY.—An article on the explanation of the action of the Wehnelt interrupter by the "pinch effect," with reference to a recent article of Ludewig.—*La Lumière Elec.*, Nov. 13.

Measurement of High Inductions.—E. GUMLICH.—The conclusion of his paper describing a modification of Ewing's

battery, which was furnished and installed by the Electric Storage Battery Company, consists of 300 cells of "Chloride Accumulator" type G-23, having a capacity of 880 amp for one hour. This battery is illustrated in Fig. 1. For controlling the charge and discharge of the battery a motor-driven booster was installed together with a motor-driven exciter controlled by the Electric Storage Battery Company's carbon regular. This regulator is operated by an alternating-current solenoid connected to the generator circuits in such a way as to respond to small variations of combined load on all of the units which are in operation at any time. The battery with its booster in series is connected directly across the 600-volt, direct-current bus in parallel with the rotary converters which feed the railway circuit at that point. As stated above, however, the operation of the battery is so controlled as to regulate the total load on the system and fluctuations of this total load above or below the average, whether originating at the power-house substation or at one or more of the others, are handled by the battery, which charges from or discharges into the direct-current busbars at the power-house substation to effect this result. Thus, if a heavy increase of load should occur at one of the remote substations, the battery will relieve the direct-current load at the substation where it is located to a sufficient extent to compensate for the increase elsewhere and hold the total load on the system constant. If the increase in load is sufficient, the battery may take the entire direct-current load of the converters at the power house and upon further increase discharge back through these into the alternating-current circuits.

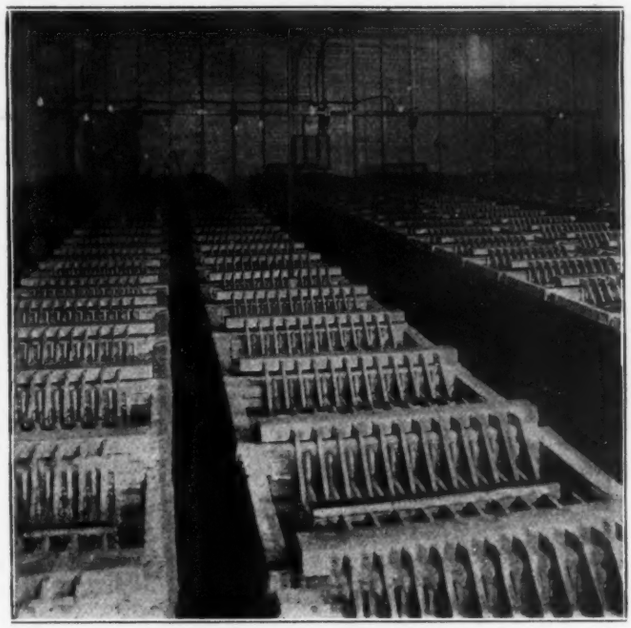


FIG. 1.—STORAGE-BATTERY INSTALLATION OF THE OSTEGO & HERKIMER RAILROAD COMPANY.

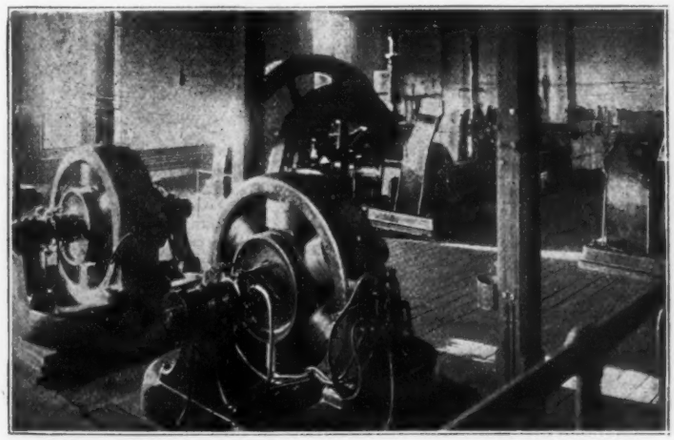


FIG. 2.—INTERIOR VIEW OF STEAM STATION AT HARTWICK.

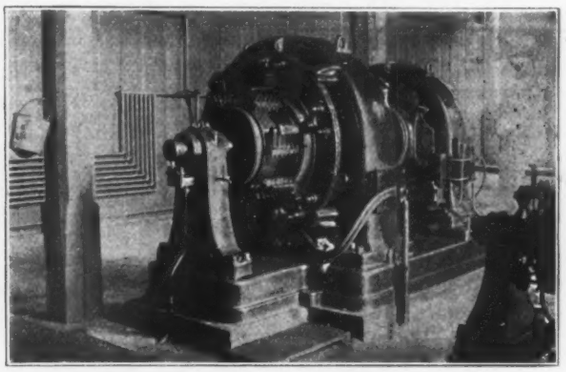


FIG. 3.—MOTOR-DRIVEN BOOSTER SET.

Fig. 2 is an interior view of the steam-power station showing the two steam-driven units, with the two rotary converters in the foreground. Fig. 3 is the motor-driven booster, while Fig. 5 shows the switchboard. Fig. 4 is a load diagram showing the results obtained by the battery operation. The heavy line represents the total generator load, while the light line is the total combined load of all the substations, the difference be-

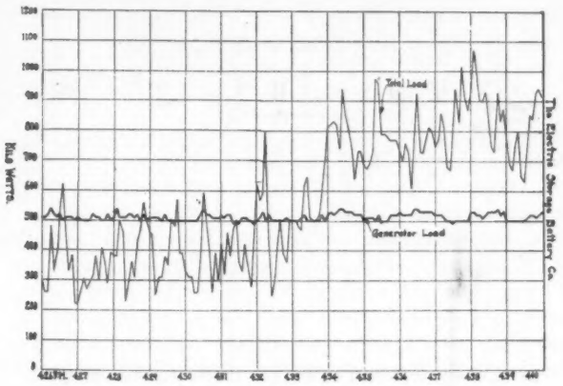


FIG. 4.—LOAD DIAGRAM.

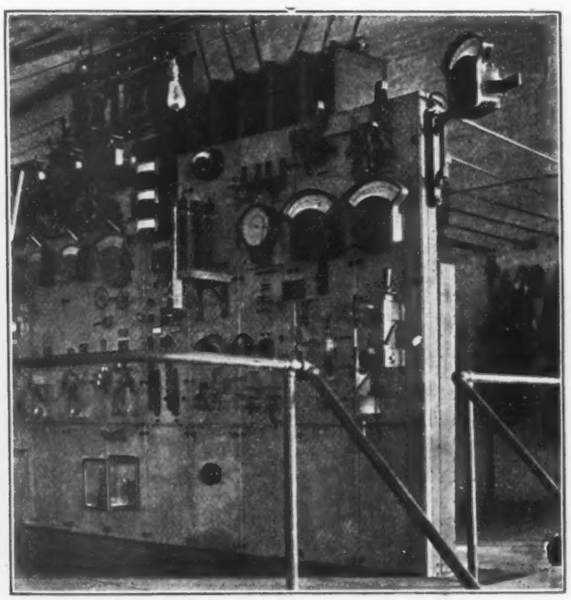


FIG. 5.—SWITCHBOARD SHOWING BATTERY CONTROL PANELS.

isthmus method for testing solid steel and dynamo sheets to determine induction curves from $H = 130$ to beyond the limit of saturation conveniently and with sufficient accuracy. The results are given for a large number of quite different kinds of iron and steel.—*Elek. Zeit.*, Nov. 18.

Meters.—An official communication of the Reichsanstalt by which two types of meters of the German Ferranti Meter Company are admitted for calibration. One is a mercury motor meter for direct current and the other is an induction meter for single-phase and three-phase currents.—*Elek. Zeit.*, Nov. 18.

Meters.—E. P. Austin.—An illustrated article on the principles of mercury motor meters and electrolytic meters.—Lond. *Elec. Review*, Nov. 19.

Telegraphy, Telephony and Signals.

Telephone Trials.—C. Egner and I. G. Holmström.—An account of tests made with the new high-current microphone of the authors which has already been noticed in the Digest. A description of the microphone is not given, but from the results of tests described it appears that the Egner-Holmström microphone enables telephone communication to be maintained on wires with a damping coefficient up to 8.0, the frequency being 800. Commercial telephony has been proved to be possible on a wire with a total damping coefficient of from 6 to 7. The trials showed also that the limit for commercial telephony with the telegraph office's microphone (and generally with all microphones of the type now in use) was reached when the total damping coefficient amounted to 3 or 4. Taking these damping coefficients the distance can be calculated to which commercial telephony will be possible on wires of different kinds, either when using the ordinary microphone or when using the Egner-Holmström microphone:

Type of wire.	Ordinary telephone 3	Damping coefficient 6	Egner-Holmström telephone 7
Copper 3.0 mm.	1,000 km.	2,000 km.	2,500 km.
Copper 4.5 mm.	1,900 km.	3,800 km.	4,400 km.
Iron 3.0 mm.	200 km.	400 km.	500 km.
4.0 mm.	300 km.	600 km.	700 km.

When increasing the distance it must be observed that the strength of the talking current should be increased in greater proportion than the damping coefficient. Supposing, for instance, the strength of the current necessary for a wire with a damping coefficient of 4 to be *a*, the strength of a current for a wire with a damping coefficient of 7 will have to be about 20 *a*, if the sound received is to be of the same strength. Some results are also given of long-distance telephony between Sweden and Germany.—Lond. *Electrician*, Nov. 19.

Miscellaneous.

Solving Equations.—A. Russell and J. N. Alty.—A description of a new electromagnetic method of studying the theory of and solving algebraical equations of any degree. While a former electrical device of A. Wright enables one to find approximate values of the real roots of an equation at once by simple mechanical and electrical operations, the new method gives approximate values of all the imaginary roots as well as all the real roots. It is, however, not as accurate as the other method.—*Phil. Magazine*, November.

Electric Ignition.—J. W. Warr.—A paper read before the Manchester Section of the (British) Institution of Electrical Engineers, giving a description of the most usual forms of high-tension and low-tension electric ignition systems, both with battery and coils, and with magnetos, chiefly with respect to the arrangements employed on automobile engines.—Lond. *Elec. Eng'ing*, Nov. 11.

Vulcanized Fiber.—L. S. Roussau.—The conclusion of his article on the properties of vulcanized fiber. The author discusses the mechanical properties and insulating resistance and the commercial and industrial applications of vulcanized fiber. —*L'Industrie Elec.*, Nov. 10.

Exposition of Nancy.—J. Reyval.—A continuation of descriptions of various exhibits at the international exhibition in Nancy, including piston valves for steam engines of Dujurdan & Company, the Beck arc lamp, and meters for a variable tariff.—*La Lumière Elec.*, Nov. 6.

Kapp.—A biographical sketch with a portrait of Dr. Gisbert Kapp, the new president of the (Brit.) Institution of Electrical Engineers.—Lond. *Elec. Review*, Nov. 12.

NEW APPARATUS AND APPLIANCES

The Storage Battery Installation of the Otsego & Herkimer Railroad Company.

The Otsego & Herkimer Railroad Company operates the electric railway system formerly controlled by the Oneonta & Mohawk Valley Rairoad Company, consisting of a main line extending from Oneonta to Mohawk, N. Y., a distance of about 55 miles, with a three-mile spur from Index to Cooperstown and about three miles of track for local service in Oneonta. The electricity is developed at two different power houses, one a steam plant located at Hartwick, N. Y., about 18 miles north of Oneonta on the line of the road, while the other is a water-power station located on the Susquehanna River at Colliers, N. Y., about 15¼ miles from the steam station. Energy from the water-power plant is transmitted at 13,000 volts, three-phase, 25 cycles, to the alternating-curent bus in the steam station and from there over a 1300-volt, three-phase transmission line to the other substation. There are four other substations, one at West Oneonta, about 11 miles south of the power house, one at the power house, one at Schuyler Lake, about 17 miles north of the power house, and one at Henderson, 30 miles north of the power house. The substations are equipped with 300-kw, 600-volt converters, one of these being located at West Oneonta, two at the power house, one at Schuyler Lake and two at Henderson.

In the steam station at Hartwick are installed two three-phase alternators, direct-connected to horizontal, cross-compound steam engines. The generators are rated at 500 kw each. One develops current at 13,000 volts, while the other generates 370 volts, the latter being suitable for direct connection to the alternating-current terminals of the power-house converter. The high-tension and low-tension busbars in the station are interconnected by a set of static transformers permitting electricity to be transmitted between the two buses in either direction, according to the demand, when both generators are in operation; or permitting either generator alone to feed both sets of busbars. Two steam-driven exciters are installed for exciting the generator fields, each having a capacity of 30 kw at 110 volts.

The water-power plant, which was built after the road had been in operation for some years, includes two 1000-kw, 2300-volt, 25-cycle, three-phase alternators, each direct-connected to a hydraulic turbine receiving water under a 33-ft. head. The tension is stepped up to 13,000 volts and electricity is transmitted at that voltage to the steam station. This water-power plant carries the entire load whenever there is sufficient water, while at times of low water supply it operates in parallel with the steam plant.

The battery and auxiliary apparatus are installed at the steam-power house, and were designed to operate in connection with the two steam-driven units. Later, when it was decided to build the water-power plant, the regulating apparatus was modified so as to permit the battery to regulate the load on either of the steam units or on the feeder from the Colliers plant or on any combination of these operating in parallel. The

tact alternately at HH^1. Two springs KK^1 bearing on two regulating screws JJ^1 are provided for tuning up the apparatus. It will be noticed that when the coil on the armature is polarized by one of the cells and the two coils AA^1 are fed by alternating current, that the armature will be alternately attracted and repelled. The make-and-break taking place at zero current all sparking is avoided.

The before-described type of apparatus is the one used in all cases where storage batteries are to be charged. In any case where it is required to use a rectifier for running motors, plating, lighting and in all cases where no storage batteries are in

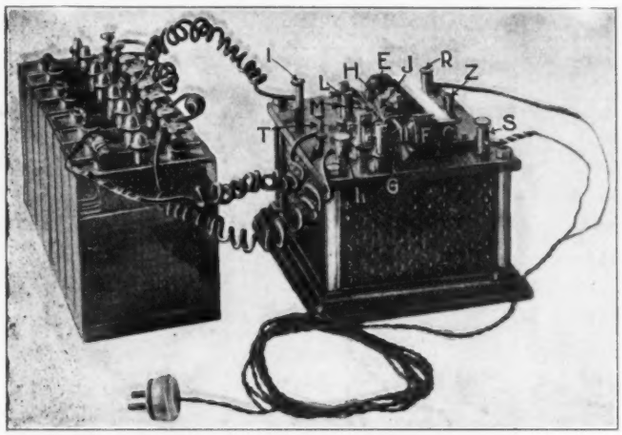


FIG. I.—ALTERNATING-CURRENT RECTIFIER.

use, the apparatus is built with a permanent magnetic field and the field produced by the alternating current tends to increase or neutralize this magnetic field alternately at each pole, the effect being a synchronous oscillation of the armature. The consumption of the two coils fed with alternating current is about 5 watts and that of the polarized coil is 0.3 amp, supplied by the first cell of the storage battery to be charged, which makes in all a consumption of 5.6 watts, which is practically insignificant. These consumption figures are the same for all rectifiers up to the 500-watt apparatus. It will be noticed that in the case of the 500-watt equipment the loss is about 1 per cent. In larger sizes the loss is proportionally larger.

It is said that all of the rectifiers will start at any load without any sort of auxiliary resistance or anything else. The efficiency of the rectifier is said to be 90 per cent and above.

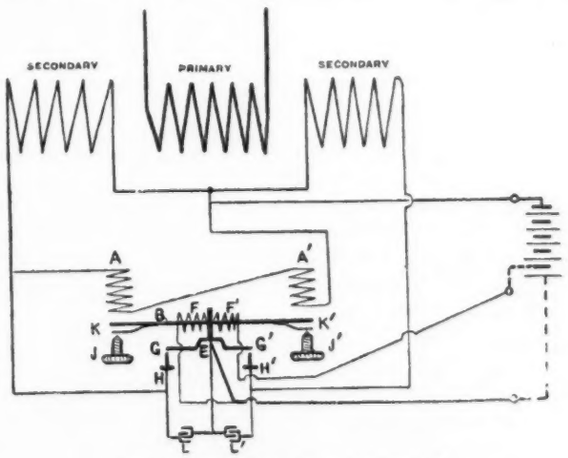


FIG. 2.—DIAGRAM OF CONNECTIONS.

These rectifiers are manufactured in all ranges from 30 watts to 5000 watts. They will also work on any frequency. These rectifiers are also built so that the same machine will furnish any number of different voltages. The apparatus here described has been placed on the market by the Premier Ampero Electric Company, Premier House, Dover Street, London, England.

Phantom Loading Device for Testing Meters.

In the testing of wattmeters and watt-hour meters it is not essential for the load registered on the meter actually to be supplied to a consuming device by way of the meter; it is necessary merely for the currents in the series and shunt coils of the meters to have definite values and time-phase relations with respect to each other. Thus, by supplying the current for the series coils from a low-voltage source the energy actually

PHANTOM LOADING DEVICE.

utilized will be only that absorbed by the meter itself, which will be a small percentage of the amount registered by the meter.

In the phantom loading device illustrated herewith the current for the series coils is adjusted by means of resistances in parallel in the secondary circuit of a step-down transformer. When the proper voltage is available, the selective switches shown give current values of 0.5, 1, 2, 5, 10 and 15 amp and any combination thereof. In order to eliminate the difficulty occasioned by the potential drop in the leads interfering with the predetermination of the current, the resistances are contained in the flexible leads used in connecting the instruments. This arrangement allows the space available to be utilized to the best advantage, and insures the minimum of time-phase displacement between the shunt voltage and series current—that is, it insures the equivalent of a power factor of nearly unity at all indicated loads.

The above-described device has been placed on the market by Henry J. Blakeslee, 603 South Crouse Avenue, Syracuse, N. Y. The apparatus is assembled in a portable leather case in which ample space is provided for all tools, seals, etc., which must be carried when testing meters in place.

Porcelain Pothead.

The Colonial Sign & Insulator Company, of Akron, Ohio, has brought out a new type of overhead, high-tension cable terminal box or pothead made of brown glazed porcelain, the only metal parts being the terminal contact blocks and the supporting clamp ring. The device was developed for the Cleveland Electric Illuminating Company, which has used it during the past year, and one illustration shows an installation on this company's 2300-volt lines. In order to determine the reliability of this type of pothead, some were mounted and subjected by the company's engineers to continuous tests under actual service conditions, on voltages ranging from 6600 to 13,200 for a period of eight months. A laboratory test showed that at 30,000 volts arcs would occur from one terminal to another, but no breakdown would ensue.

As may be seen from the illustrations given on page 1434, the pothead consists of a peculiarly shaped body, with a suitable cover bell. The cable enters the neck of the body or pothead proper, and the conductors separate within the neck, and are then brought out and screwed into the contact blocks through

tween these two lines representing the battery charge or discharge. This diagram was taken with one of the steam-driven units in operation. Fig. 6 is a portion of the record of a curve-drawing wattmeter at the water-power plant showing the output of this plant from 4 p. m. to 6 p. m. on June 9, 1909. At this time the steam units were shut down and the water-power plant, in conjunction with the battery, was carrying the entire

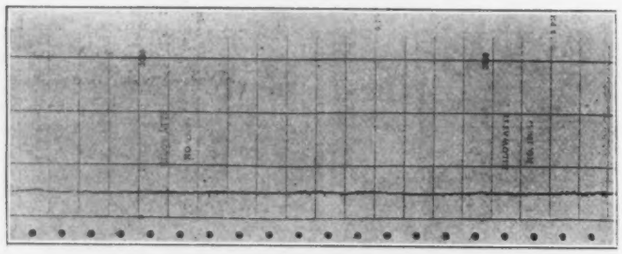


FIG. 6.—RECORD OF RECORDING WATTMETER.

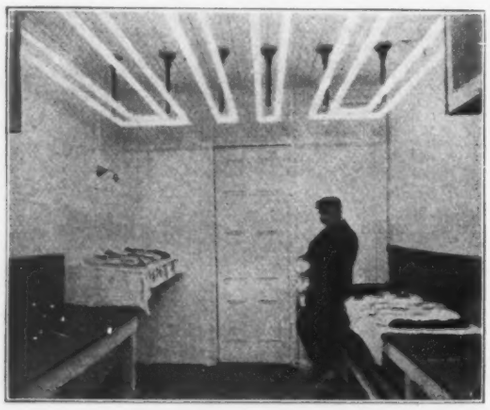
load. When it is remembered that this record shows the output of a generator supplying energy to meet the rapidly varying load of an electric road operating a number of heavy interurban cars, it will be seen how the battery and its regulating apparatus relieve the generating machinery of the severe fluctuations.

Vacuum-Tube Light in Silk Mills.

Dyers, color matchers and textile workers have always been handicapped by the fact that their standard of color value—daylight—varies, and, of course, is only available part of the day. The introduction of the Moore white vacuum-tube light in the dye shop and kindred establishments has worked a marked change in these industries.

For example, silk dyers whose busy season is in winter, very frequently had to shut down part of their plant early in the afternoon on dark days, as matching was no longer possible. This naturally caused considerable loss and annoyance. With the Moore white vacuum-tube light matching is possible at all times, and now dye shops equipped with matching rooms are enabled by means of this light to work on regular schedule, and many have started running nights.

Below is illustrated one of the matching-rooms of the Weidman Silk Dyeing Company, of Paterson, N. J., equipped with two 66-ft. Moore tubes. In this installation the tubes are alternately connected to the two sides of a two-phase, 60-cycle, 220-



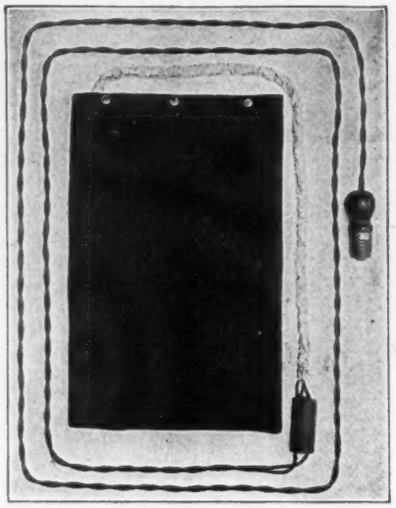
VACUUM-TUBE LIGHT IN SILK MILL.

volt, alternating-current circuit. Connected in this manner, the stroboscopic effect apparent in alternating-current lamps becomes negligible.

Woolen and worsted mills also use this light at their perches for examining cloths, an operation which heretofore could only be done under clear daylight. Color experts of paint factories, coated-paper mills and color works have also found the Moore white light invaluable to match and standardize colors with. The Moore Electrical Company, of Newark, N. J., manufacturer of the Moore light, has also made a "Daylight Window" for color matching, which is semi-portable and suitable for small plants.

The Electropad.

A new electric-heating pad is being put on the market by the C. A. Shaler Company, of Waupun, Wis. These pads are provided with automatic thermostats which cut off the current when the temperature of the pad reaches 180 deg., so as to



ELECTROPAD.

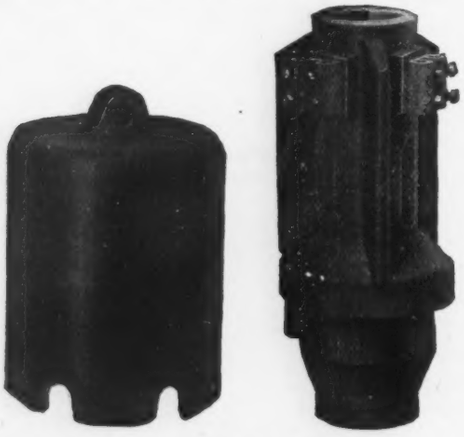
prevent overheating. In their construction wires are wound around an asbestos cord embedded in three layers of asbestos. A three-way switch is provided so as to give three different heats, the switch being cylindrical in shape, as shown in the accompanying engraving. To change the connections from one heat to another one-half of the switch is rotated on the other half without separating the two parts. Knobs projecting from the sides of the switch make it easy to tell on which point the switch is placed in the dark. This is a practical advantage appreciated by those who have used electric-heating pads heretofore and have wished to change connections at night without turning on the light. These pads are made either with silk or rubber covers, either of which can be easily removed.

Electro-Magnetic Alternating-Current Rectifier.

The alternating-current rectifier illustrated herewith depends for its operation on the fact that if the two secondaries of a transformer are alternatively put into circuit at each half period the current in the secondary circuit will be unidirectional. An apparatus built on these lines ought to be particularly efficient, as there will be practically no loss except the ordinary small loss of the well-built transformer, and practice is said to bear out this anticipation, as tests made with this rectifier show a loss of only from 5 to 6 per cent including the energy consumption of the field-magnet coils used to effect the switching in and out of the two secondaries mentioned.

The apparatus consists of two parts, a transformer wound with two secondaries and an auto-transformer with a middle point which acts as a phase divider, and secondly, the rectifier. This latter consists of a polarized armature which is pivoted and free to oscillate. Facing either end of this are two coils AA^1, as shown in Fig. 2, fed from one of the secondaries. It will be noticed that these are wound so that the poles facing either end of the armature are similar. The armature carries a contact piece E, which, as the armature oscillates, makes con-

the slots provided. Barriers between the phases prevent creeping and short circuiting. The overhead leads are led up into the contact blocks through notches in the cover, so as to form a natural drip loop. When paper insulated cables are used, as is the case in Cleveland, the insulation is protected by a wrapping of varnished cambric tape, or by splicing gum tape served with P. & B. paint. This is made to extend somewhat below



FIGS. 1 AND 2.—PORCELAIN POTHEAD.

the end of the lead sheath. The body is fitted with a lug and a clamp, and with a socket to prevent the pothead from turning, and the cover bell is fitted with lugs between which the barriers of the body engage in order to locate the lead openings in a definite position with reference to the conductor slots in the body.

The type illustrated weighs 18 lb. complete, and, while designed for three-phase, 2300-volt circuits, has been found to operate successfully on 6600 volts, and to take cables up to 1⅞ in. outside diameter. Potheads for single-phase, two-phase or three-phase service, and for higher voltage or larger diameter cables, can be furnished in this type if desired. The only compound used in the pothead is about a half teacupful, which is poured into a small pocket formed at the top, into which the bolts holding the terminal blocks converge. No compound is required to protect the end of the cable. The advantages claimed for the pothead are simplicity, compactness, lightness, rigidness and neatness.

The removable cover bell of the pothead permits of rapid inspection; the screw connections in the contact block of

FIG. 3.—PORCELAIN POTHEAD.

quick disconnection for test or other purposes; the manner of bringing in cables and leads prevents the ingress of moisture; the cable sheath does not have to be wiped on to the body, and its outer diameter is immaterial as long as it will enter the neck of the pothead.

A Non-Freezable Oil.

The Ricker Manufacturing Company, of Rochester, N. Y., has had prepared for its fuse boxes a non-acid, high-test, non-freezable oil, known as the "Rochester Fuse Oil." This oil will be of great interest to companies in the colder climates, both for fuse boxes and transformers. It will remain in its normal condition at a temperature of 40 deg. below zero.

Convenient Household Electric Heating Devices.

The accompanying illustrations show three convenient electric heating devices made by the Simplex Electric Heating Company, of Cambridge, Mass. The breakfast room toaster shown in Fig. 1 has a polished metal case, in the center of which an upright electric heater extends from end to end. On each side is a door swinging outward and backward which opens sufficiently to permit the placing or removal of the bread without

FIG. 1.—TOASTER.

FIG. 2.—MILK WARMER.

danger of burning the fingers. When not in use the doors are closed so as to confine all the heat for effective work on the bread.

The flexible conductor cord is provided with a lamp-socket plug and another plug, by which the toaster itself may be switched into or out of circuit. The walls of the casing are doubled with an air space between, and the interior surfaces are brightly polished so as to provide reflectors for the heat. Two large or four small slices of bread may be toasted at one time in from two to three minutes. The construction throughout contains no fragile or delicate parts or soldered joints. The walls and doors are smooth polished, with ebony-finished handles. The crumbs from the bread fall within the casing of the walls and doors on a porcelain enameled base, and by removing the doors the crumbs may be instantly removed.

The nursery milk warmer shown in Fig. 2 consists of a nursing bottle, an electric heating coil and a copper receptacle to contain the bottle and coil immersed in a water bath. The heat is given out uniformly on all sides, so that the milk may be brought to an even temperature quickly without any portion of it being overheated and rendered indigestible. Each milk warmer is furnished with 6 ft. of cord and a lamp-socket plug, arranged so that the lamp itself is lighted while the milk is being warmed.

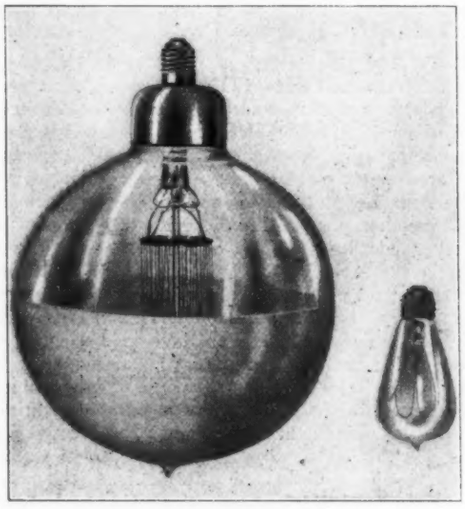
As electric lighting in hotels is practically universal, the

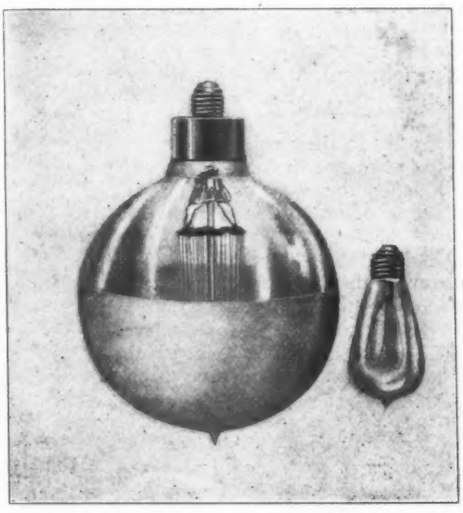
FIG. 3.—TRAVELER'S STOVE.

traveler's stove, shown in Fig. 3, should find wide use. The stove and cord pack inside the cup, and the cup handles fold up snugly, the whole apparatus measuring 3¼ in. x 5 in., and weighing 2½ lb. An asbestos pad and 6 ft. of cord and a plug form part of the outfit.

Thousand Candle-Power Tungsten Lamp.

The accompanying illustrations show two very large incandescent lamps equipped with tungsten filaments imported by the Electrical Accessaries Company, of New York City. That shown in Fig. 1 is rated at 1000 cp, and that shown in Fig. 2 is rated at 600 cp, the specific consumption in each instance being claimed to be 1.1 watt per candle. In order that some conception may be obtained of the size of each lamp, an ordinary 16-cp carbon-filament lamp is shown to one side of it in each engraving. The 600-cp lamp has a round globe 8 in. in diameter, while the globe of the 1000-cp lamp is 9 in. in diameter. Each lamp is made up of two filaments in parallel, so that if one filament breaks, the other filament will remain in service and the lamp burn at half rating. The lamps are designed to take the place of ordinary arc lamps, and flaming-arc lamps for interior illumination. The filament is anchored in the center and also at the bottom, and the connections at the top are fused electrically. The anchors at the middle and bottom are arranged so that one leg of the filament is in a different plane from the other. This results in obtaining better distribution, and prevents the filaments from touching each other. There are 16 complete loops in the 600-cp lamp, and 20 complete loops in the 1000-cp lamp, the length of the loop being about 6 in. in each case. The anchors are held by a glass rod over ⅛ in. in diameter, as indicated in Fig. 3, which shows the arrangement of one-half of the filament in a 1000-cp lamp. The lamps are fitted with Edison bases so as to screw into an ordinary incandescent lamp socket. They are designed for voltages ranging from 100 to 120, and from 200 to 250. With the introduction of these lamps there are now available tungsten lamps ranging in candle-power from 16 to 1000, those above 100 being rated at 200 cp, 300 cp, 400 cp, 600 cp and 1000 cp.





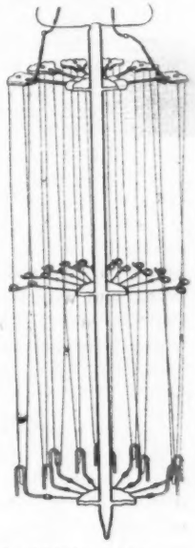


FIG. 1.—1000-CP TUNGSTEN LAMP. FIG. 2.—600-CP TUNGSTEN LAMP. FIG. 3.—ONE-HALF OF FILAMENT IN 1000-CP LAMP.

Tailor's Electric Iron.

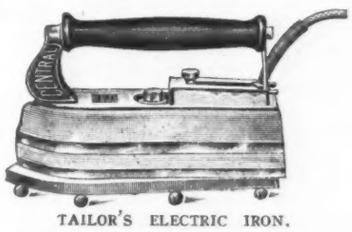
The requirements of a tailor's iron are more exacting than are those of other irons and the faults more or less common to the majority of electric irons are therefore more conspicuous in the tailor's iron. High efficiency is desirable, as the quantity of energy required to do a given work is such that a saving of 25 per cent is important. Another esential feature is quick starting characteristics, the absence of which makes the tailor's iron prohibitive in a job shop where it is required often for only one job taking five minutes to perform. The factor of endurance is of prime importance and necessitates careful design, first, because the nature of the work requires a larger volume of heat and much higher temperature, and second, because of the inherently slow starting ability and the intermittent nature of the work there is more temptation to let the iron stand with the current on, in order that the iron be ready for use. The first of these makes it necessary to wind the heating element for excessively high temperature, and the second increases the danger of burn-out still further.

With a full knowledge of the conditions to be met the Central Electric Company, Chicago, Ill., has placed on the market the "Universal" tailor's goose illustrated herewith, which is a development of its 4-lb. and 6-lb. irons with the necessary changes in design to meet the necessary conditions imposed by the severe service met in tailor shops. A prominent feature of the new iron is the three-heat switch plug, by which all heats can be controlled by a simple motion of the hand while ironing.

This desirable feature is accomplished without withdrawing any plug from the iron, or turning any auxiliary switch. The heating elements are so arranged that the heat is distributed over the bottom of the iron equally well at any one of the three heats, and at the same time maintain an equally high efficiency on any of the three heats.

The advantages claimed for the new iron are that it gives a greater range of control of temperature than can be obtained by ordinary switch-plug, or by other means. The low heat can be so arranged that the quantity of current consumed will just maintain the iron at a temperature while standing indefinitely.

The first advantage is of particular importance to manufacturers who have special temperature requirements and where the nature of the work varies greatly. The second is more important in job shops where an iron is more liable to burn out, which this feature prevents by allowing the iron to stand at a low heat instead of at a high one. Thus the iron is always maintained at the correct temperature while standing between jobs and does not cool off, nor get any hotter. This enables the operator to pick up the iron and go ahead any time without waiting, whereas should the full heat be left on, leaving out the question of consumption, it would become too hot. The medium heat is used only when very light work is to be done, or where only one piece is to be pressed. For continuous wet work full heat is used. The switch-plug works progressively in and out—that is, the first notch is off, the second is for one-quarter or low heat, and the third for half or medium heat, while clear in gives full heat.



TAILOR'S ELECTRIC IRON.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

While the reports from retailers continue to be that business is good, there have been some complaints during the past week concerning the continuance of unusually mild weather and the resulting falling off of sales of heavy clothing and winter underwear. In some sections of the West, also, continuous rain has rendered the roads almost impassable and thereby restricted the sales at county seats, which are dependent upon rural purchasers. In the cities of the country there has been very gratifying holiday business. In fact, the Christmas trade is said to be the best since 1906. Among the jobbers and wholesalers new orders are not very plentiful, a condition which is to be expected at this season of the year, but quite a number of reorders are being received, which indicates that retailers have for the most part been conservative in their original purchases and that at the present time they are not heavily stocked with wares. The industrial condition continues to be enthusiastic. There are few signs of slackening of orders and the iron and steel mills will be running overtime for many months to come on the business already booked. The switchmen's strike in the Northwest has interfered to some extent with a number of flour mills and other manufacturing plants in that section. It has also caused some congestion of traffic. It is not believed, however, that this strike will be serious or that it is liable to spread to other sections of the country. It is not improbable, however, if the present high prices for commodities continue that demands for advance in wages may be reasonably expected next spring. Collections throughout the country are fairly satisfactory and bills are being met with greater promptness than at any period since the beginning of the times of depression. While there were more failures with larger liabilities in November than there were in October, the comparison with the past two years continues to be very favorable to 1909. Failures for the week ending Dec. 2, as reported by *Bradstreet*, were 230, compared with 217 the previous week, 234 in 1908, 272 in 1907, 216 in 1906, and 203 in 1905.

THE COPPER MARKET.

The condition of the copper market during the past week was distinctly better than during the week previous. Prices, however, were slightly lower for a time, and there was more evidence of anxiety on the part of holders to dispose of metal. This may have been the cause of the unusual volume of sales. It was generally understood that domestic melters are using much more raw material than at any previous time within the past two years. Wire drawers, brass foundries and sheet mills are all calling for heavier deliveries. The majority of the domestic consumers have purchased copper sufficient for their needs for delivery during December, January and February, and orders placed now, as a rule, are for spring delivery. On Dec. 6 heavy buying orders were received from abroad, and there was a sharp advance in the London market, followed, of course, by a comparative advance in the local market. The entire undertone is much stronger and more satisfactory than has been the rule during the season. The anxiety concerning the fate of the proposed copper merger, which followed the adverse decision in the Standard Oil case, has almost disappeared, and authorities who are interested in the negotiations now declare that they have no fear of Government interference, and that they are simply resting on their oars waiting for the Supreme Court to hand down a decision in the case of the Tobacco Trust. It is intimated that all of the details in the consolidation have been worked out, but they will not be made definitely public until those interested are sure of the Government's attitude. Exports for the month, including Dec. 6, have been 3718 tons. The daily call on the Metal Exchange Dec. 6 quoted standard copper as shown in the table.

	Bid.	Asked.	Settling price.
Spot	12.75	13.00	....
December	12.75	13.00	12.87½
January	12.75	13.05	12.90
February	12.80	13.15	12.97½
March	12.90	13.25	13.07½

The London prices Dec. 6 were as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	59	0	0	59	5	0
Standard copper, futures	60	2	6	60	7	6
Market	Firm			Firm		
Sales of Spot				500 tons		
Sales of futures				1,600 tons		

Extreme fluctuations for this year:

	Highest. £	s	d	Lowest. £	s	d
London, spot	£64	2	6	£54	12	6
London, futures	64	17	6	55	10	0
Standard	13.45			12.12½		
London, best selected	67	15	0	59	0	0

PARKER-CLARK ELECTRIC COMPANY.—The retirement of W. G. Clark from his connection with the Parker-Clark Electric Company and the election of Dr. George N. Miller to the office of president and director has been announced. In order to be in close touch with their laboratories, the offices of the company have been moved from the Singer Building to the Lincoln Square Building, No. 1966 Broadway. Prof. H. C. Parker continues at the head of the laboratory work, and, with the advent of Dr. Miller as the chief executive, active preparations are being made to at once place the company's products on the market. The Helion resistors manufactured by this company have been developed to meet a definite need in the electrical heating field, and, anticipating a large demand for these resistors, the company plans to start a factory for their manufacture as soon as a suitable location can be selected. Work will also be vigorously prosecuted on the Helion incandescent lamp, which is stated to be now nearing perfection, with the design of offering it to the public the coming Spring. The company is also preparing to manufacture immediately the Helion naval lamp to meet the large demand for an incandescent lamp which will stand the shock of firing large guns on board of men-of-war. The firm, strong Helion filament is stated to meet these demands admirably, even should the glass globe enclosing the filament be broken, the filament will burn in the open air for an indefinite period without apparent deterioration.

TELEPHONES FOR TRAIN DISPATCHING.—The Chicago & Northwestern Railroad Company has recently purchased from the Western Electric Company apparatus for a complete telephone train dispatching circuit extending from Chadron, Nebraska, to Long Pine, Nebraska, a distance of 198 miles. The circuit will be very complete and the line itself has been constructed entirely of new material. The Louisville & Nashville is installing a complete up-to-date Western Electric telephone train dispatching circuit between New Orleans and Mobile. This circuit will be the first to be installed in that section of the country for handling trains. This is the second circuit installed by this railroad, the former one being between Louisville and Cincinnati. The officials report that the service on this circuit is giving entire satisfaction.

NEW GENERATING STATION AT ATLANTIC CITY, N. J.—The American Gas & Electric Company has entrusted to Messrs. Sargent & Lundy, of Chicago, the design of a new 10,000-kw turbo-generator station to be erected in Atlantic City, N. J. The present station of the Atlantic City Electric Company will be abandoned, and, as intimated in the May 27, 1909, number, the new generating station will be built elsewhere in the city, and will be in keeping with the plan for the general beautification of the city by the sea. The general details of the equipment have not yet been definitely decided on.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in our present issue are announcements of proposed new plants or considerable extensions of present plants at Salt Lake City, Utah; Richmond, Va.; New Orleans, La.; Louisville, Ky.; Chambersburg, Pa.; Mason City, Ia.; Windsor, Ont., Can.; Greenville, S. C.; Fort Payne, Ala. Kimball, Va.; Jefferson City, Mo.; Nebraska City, Neb., and Ralston, Okla.

PENNSYLVANIA ELECTRIC ROAD TO NEWARK.—Plans have been prepared by the Pennsylvania Railroad Company for the electrification of its line from Harrison, N. J., where the Thirty-third Street tunnel line joins the main line which has heretofore run into Jersey City, to the Park Place station, Newark. It is proposed on this line to run through trains from Newark to the Hudson Terminal Buildings, at Cortlandt Street, and to transfer passengers at the Harrison, N. J., station to trains that will take them to the main terminal at Thirty-third Street and Seventh Avenue, New York. It is said that later on a local service may be installed between the Thirty-third Street terminal and Newark. All through trains coming into New York over the Pennsylvania line will stop at the Harrison station so that any passengers who desire to go into the lower end of Manhattan can there transfer to the Hudson Terminal station.

SOUTHERN PACIFIC ELECTRIFICATION. — The Southern Pacific Railroad Company is considering the electrification of 110 miles of its main line over the Sierras. This work, which will probably begin in the near future, will be the most important piece of mountain electrification yet installed in any country. It is also likely that, if the work is completed as now proposed, the Southern Pacific will have the longest stretch of electrified main line in this country. The only competitor will be the New Haven Railroad, which is pushing its electric zone east from Stamford. The Southern Pacific in this section of its road has a series of 2 per cent grades, and the heavy 2500-ton freight and 800-ton passenger trains will require larger electric locomotives than any now in use.

NO MERGER OF DENVER COMPANIES.—J. R. McKee, president of the Central Colorado Power Company, of Denver, has specifically denied any community of interest between the Denver Gas & Electric Company, the Northern Colorado Power Company and the Central Colorado Power Company. It has been frequently stated recently that a merger was in progress of formation. Mr. McKee, however, stated that the companies are competing and that outside of the Leadville Lighting Company and the Breckenridge Mining District the only relation the Central Colorado Power Company has with the other companies is the selling of energy to the Denver Gas & Electric Company, as to any other customer.

LIGHTING RIVALRY IN CLEVELAND.—The Cuyahoga Lighting, of Cleveland, Ohio, of which John C. Keyes is president, has carried its fight against the Cleveland Electric Illuminating Company to the State Board of Assessors and Appraisers. Some time ago Mr. Keyes succeeded in inducing the Board of Review in Cleveland to take up the tax valuation of the old company and add several hundred thousand dollars to it. Mr. Keyes states that he will erect a plant on the lake front of 3,000 kw. capacity and a system that will cost $1,000,000. The money, he stated, would come from the East, but he refused to state who is to furnish it.

NEW MEXICO HYDROELECTRIC PROJECT.—Business men of Roswell, N. M., have been in conference with Mr. J. L. Norton, of Chicago, a hydroelectric engineer, on a plan to harness the waters of the Rio Penasco and supply electrical current to light a number of cities in the Pecos Valley and reclaim some 100,000 acres by pumping. The Penasco falls 50 ft. a mile for 30 miles, and it is estimated it would generate 1500 hp every three miles. The project has been endorsed by the Roswell Commercial Club. An interurban electric railway through the valley is expected to be constructed ultimately as a part of the project.

AMERICAN PLATINUM WORKS. — The American Platinum Works, Newark, N. J., have purchased the adjacent real estate and building formerly owned and occupied by the Caffrey Leather Company and J. Liebstein & Sons. The present buildings will be reconstructed and modernized and additional structures will be erected, which, when finished, will give the company one of the most complete plants in the world for the refining of platinum, gold and silver.

CANADIAN ELECTRICAL CONTRACT.—The Canadian Westinghouse Company secured a contract from the London, Ont., Power Committee on Dec. 3, for electrical apparatus for the municipal system, amounting to $51,908. The total tender of the Westinghouse Company amounted to $64,058, but included in this were one motor-generator set and a street arc lighting equipment, awards for which have been deferred.

GREELEY-DENVER ELECTRIC RAILWAY.—Harold K. Knight, of St. Louis, is in Denver looking over the country with a view to building an electric line between Greeley and Denver. Mr. Knight represents Missouri capitalists, and it is understood that he will try to buy out companies which have secured rights of way and other privileges between the two cities and start work on the line within three months.

ELECTRIC LOCOMOTIVES FOR JAPAN.—In a news paragraph, published in the issue of Sept. 16, concerning the sale of 12 30-ton electric locomotives to the Japanese Government it was erroneously stated that the contract had been made with the Siemens-Halske Company. As a matter of fact, the contract was placed with the Allgemeine Elektricitäts Gesellschaft, of Berlin.

COLORADO ELECTRIC PUMPING PLANT.—The city of Montrose, Col., has voted to install a 1500-gal.-per-minute centrifugal pump, to be driven by 2200-volt, three-phase, 60-cycle electric motor direct-connected, the entire equipment to be in strict accordance with the requirements of the National Board of Fire Underwriters for standard centrifugal fire pumps.

HEANY LAMP COMPANY.—The Heany Lamp Company announces that its new factory at Weehawken, N. J., will be completed within a few months and will be turning out 10,000 tungsten lamps daily. The factory at Flint, Mich., is now running full time and is making 10,000 lamps daily. The management of the company declares that the demand for lamps is very satisfactory.

INCREASE CAR BUILDING PLANT.—The Woeber Car & Carriage Company, which has been established in Denver for 42 years, and has built practically the entire rolling stock of the Denver City Tramways Company, has bought 13 arces of land in Adams County, near Denver, and will begin within a year the erection of extensive new car and automobile shops.

SOUTHERN COLORADO POWER COMPANY.—The Southern Colorado Power & Railway Company of Trinidad has been reorganized, and it is stated that $1,000,000 will be spent on improvements at once. Plans for reorganization have been perfected in New York by F. T. Reid, receiver, and Attorney Fred T. Henry, of McKnight & Henry.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market last week appeared to have recovered, to some extent, from the extreme nervousness which had been caused by the Standard Oil decision. It seems to take a very small noise to frighten many of the timid traders in these days

NEW YORK.

	Nov. 29.	Dec. 6.	Shares sold.		Nov. 29.	Dec. 6.	Shares sold.
All.-Ch.	15½*	15½	6,020	Int.-Met.,pfd.	54½	58¼	57,700
All.-Ch., pfd.	53¼	55¼	4,100	Mackay Cos.	92½	92½	4,000
Amal. Cop.	84⅛	86¼	598,800	MackayC.,pfd.	76⅛	77⅛	1,000
Am. D. T.	20½*	20½*	——	Man. Elev.	139⅞	139⅛	1,392
Am. Loc.	59¾	60¾	8,950	Met. St. Ry.	23*	23*	——
Am. Loc., pfd.	115	114¾	420	N.Y.&N.J.Tel.	139¼	139¼*	——
Am. Tel. & C.	83*	83*	——	Steel, com.	86	89⅜	947,770
Am. T. & T.	140¼	140	22,080	Steel, pfd.	123½	124½	16,187
B. R. T.	77	81⅞	73,165	W. U. T.	77½	78¼	5,400
Gen. Elec.	159½	160	6,592	West'h., com.	83⅛	84½	7,800
Int.-Met.,com.	22½	24⅜	121,580	West'h, pfd.	136½*	134*	300

PHILADELPHIA.

	Nov. 29.	Dec. 6.		Nov. 29.	Dec. 6.
Am. Rys.	45⅛	45⅛*	Phila. Elec.	13	13½
Elec. Co. of A.	12⅜	12⅜*	Phila. R. T.	25⅞	27½
Elec. St. B'ty	58	57	Phila. Trac.	89*	88½*
E. S. B'ty, pfd.	30*	30*	Union Trac.	52⅛	53¾

CHICAGO.

	Nov. 29.	Dec. 6.		Nov. 29.	Dec. 6.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	135½	135
Chi. Rs., Ser. 1	98	98*	Met. El., com.	17*	17*
Chi. Rs., Ser. 2	32	30¾	Met. El., pfd.	51½	51½
Com. Edison	119	117	Nat'l Carbon	97	97½
Chi. Subways	5⅛	4½	Nat'l Car., pfd.	124*	120*

BOSTON.

	Nov. 29.	Dec. 6.		Nov. 29.	Dec. 6.
Am. T. & T.	140¾	140⅛	Mex. Tel.	3*	2¾*
Cum. Tel.	147*	145⅞*	Mex. Tel., pfd.	6*	6*
Edison E. Ill.	250*	250	N. E. Tel.	134¾	134¾
Gen. Elec.	161¼	160½	W. T. & T.	12	12*
Mass. E. Ry.	16*	15½	W. T. & T., pfd.	89½	90*
Mass. E. R., pfd.	80	76¼			

* Last price quoted.
Shares sold are for week of Nov. 29 to Dec. 4.

of high prices and uncertain money markets, and the anti-trust decision scared many speculators to cover. After the hurried liquidation of a few days, the sober second thoughts appear to have prevailed, and the fear that the financial world was coming to an end, because of an adverse decision in a lower court, has apparently been assuaged. While the market last week was not particularly active, there was a good buying movement almost every day, and the result of trading for the week was a considerable advance in almost every leading issue. Even the copper shares, which are recognized as the most risky propositions in the market, on account of the well-known overproduction of metal, were strengthened during the close of the week and recorded advances. Talk of the great copper merger was resumed, and people who a few days before were loudly asserting that the Government would never permit such an organization, have changed their minds, and are willing to buy a few shares of the copper companies on the prospect of the controlling amalgamation. Although there was some talk in Wall Street as to what would be said in President Taft's first annual message to Congress, no one seemed to be particularly nervous. It was generally the opinion that the President would not be so radical as to disturb either the industrial corporations or the railroads. The traction stocks, especially Interborough-Metropolitan issues, continue to be very active, and, with the exception of Third Avenue, recorded advances. In the case of the latter the promulgation of a plan which contemplated a $45 assessment was sufficient to cause many holders to sell. The money market has not been particularly interesting during the week. While there have been some shipments of gold to South America, they have not been of sufficient volume to inconvenience the banks. Rates have remained about the same, both in this country and in Europe. On Dec. 6 quotations were: Call, 4 and 5 per cent; 90 days, 4¾ per cent. The quotations in the table are those of the close, Dec. 6.

CHICAGO SUBWAY RECEIVERSHIP.—Judge C. C. Kohlsaat, of the United States Circuit Court, in Chicago, has appointed David R. Forgan, president of the National City Bank, and Charles G. Dawes, president of the Central Trust Company of Illinois, receivers for the Illinois Tunnel Company, and Edwin A. Potter, president of the American Trust & Savings Bank, receiver for the Chicago Warehouse & Terminal Company. The Chicago Subway Company, which in 1904 took over the Illinois Tunnel Company and the Chicago Warehouse & Terminal Company, defaulted upon the payment of its interest on $1,700,000 of bonds that was due Dec. 1. This was done in order that receivers might be appointed, and is the initial step in a plan of reorganization of the company under friendly terms. A reorganization committee of bondholders has been formed, and this committee is practically represented by the receivers appointed. It will enter upon the task of carrying to completion the tunnel and its connecting enterprises. When the Chicago Subway Company was formed in 1904 J. Ogden Armour and E. H. Harriman were the important financial interests back of the enterprise. Mr. Harriman committed the company to a policy which involved the completion of the system, so that it would connect all of the Chicago railroads. This involved a heavy expenditure, and the funds for these improvements were supplied by the Armour-Harriman interests on notes secured by first mortgage bonds of the company. Up to the present time the operations of the company have not been sufficiently lucrative to pay the fixed charges, and since Mr. Harriman's death it has been apparent that a reorganization would be necessary. On the Chicago Stock Exchange the stock of the company has declined until it reached the low point of $3.25 a share. Many stockholders believe that a reorganization would mean the practical elimination of the present outstanding stock. So far no plan of reorganization has been announced.

DENVER GAS & ELECTRIC LIGHT COMPANY.—Temporary officers for the newly organized Denver Gas & Electric Light Company, successor to the Denver Gas & Electric Company, were named yesterday, and are as follows: President, Rodney J. Bardwell; vice-president, H. H. Scott, general manager of the Doherty Operating Company; secretary, Paul R. Jones, auditor of all the Doherty Companies, and Carl B. Gilbert, treasurer. The above officials will remain in power until all the details of reorganization are complete, when the stockholders will meet and elect a board to serve one year. Plans for the reorganization are practically complete. Charles Frueauff, counsel for the company, will leave for the East at once to submit the final details to Henry L. Doherty for his approval. On account of illness, Mr. Doherty was unable to come to Denver as he had hoped to do. A mortgage will be filed shortly to cover the proposed $25,000,000 bond issue of the new company. The certificate of the incorporation of the new company, with an authorized capitalization of $10,000,000 has been filed with the Secretary of State of Colorado. The bond issue is necessary in order to take care of improvements and extensions contemplated for the next few years. The company is taking over the Denver City Steam Heating plant and proposes to enlarge it greatly. Recent investigation by the gas company shows that the growth of Denver has been for several years at a rate of 3½ per cent over each previous year.

ELECTRICAL UTILITIES CORPORATION.—There was recently incorporated under the laws of Maine a holding concern called the Electrical Utilities Corporation. The authorized capital stock is $7,500,000, of which $2,500,000 is preferred. This preferred stock was offered for subscription in London last week at par with a bonus of 80 per cent in common, and it is reported to the officers in New York that the offering was largely over-subscribed. At the office of William P. Bonbright & Company, which firm is the financial representative of the new corporation in this country, it was stated that the purposes of the organization were mainly to buy and to sell the securities of electrical utility concerns. It is not the present purpose of the company to go into the operating business, and for the present no information will be given out as to properties in which the new holding company would be interested. The directors of the company are: S. Z. Mitchell, chairman of the American Power & Light Company; S. W. Childs, of William P. Bonbright & Company; A. W. Burchard, assistant to President Coffin of the General Electric Company; A. C. Bedford, of the Standard Oil Company, and W. F. Fisher, Owen H. Smith, and L. Egerton of London.

CONTINENTAL TELEPHONE & TELEGRAPH COMPANY.—It is reported in Chicago that the Chicago & Milwaukee Telegraph Company, one of the few Independent telegraph companies of the country, has been purchased by the Continental Telephone & Telegraph Company. The concern has six wires running between Chicago and Milwaukee, and its purchase by the Continental Company would give that concern an entrance into Chicago for Independent telephone and telegraph lines. Inquiry as to the truth of this report at the office of Philbin, Beekman & Menken, the attorneys who represent the organizers of the Continental Telephone & Telegraph Company, and the only representatives of that company whose identity has been made known, elicited the response that the officers of the company were unwilling to either confirm or deny the report.

FIFTH AVENUE COACH COMPANY.—The first annual report of the Fifth Avenue Coach Company to the Public Service Commission, which was for the year ended June 30, 1909, has just been made public. The figures show that the company has at the present time an investment of about $400,000, which is more than double what it was at the end of the previous fiscal year. This increase is represented by new electric motor omnibuses. The revenue from passengers carried amounted to $369,405, and the total expense for operations amounted to $225,556, leaving a net income of about $144,700. The company marked off during the year $65,595 for depreciation, and at the end of the year there was a standing deficit on the books of the company amounting to $458,216.

WILKES BARRE & WYOMING VALLEY TRACTION COMPANY.—Negotiations were concluded last week for the purchase by Wilkes Barre interests of the Wilkes Barre & Wyoming Valley Traction Company. The consideration is said to be about $4,000,000. The company operates 99 miles of trolley line in Wilkes Barre and in the Wyoming Valley. Heretofore it has been controlled by the Interstate Railways Company of Philadelphia.

GREAT GERMAN ENTERPRISE PROSPERING.—The annual report for the Allgemeine Elektricitäts Gesellschaft for the year ended June 30, 1909, shows total net earnings, after making liberal charges for depreciation, etc., amounted to 16,384,571 M. The company paid 13 per cent dividends on its 100,000,000 M. capital stock and distributed 1,300,000 M. in bonuses to its officers and employees.

THIRD AVENUE RAILROAD REORGANIZATION.—The bondholders' committee of the Third Avenue Railroad Company, of which James N. Wallace is chairman has filed its second plan of reorganization with the Public Service Commission. The first plan was rejected by the commission in September. The new plan provides for the authorization of a refunding mortgage to secure a total issue of $40,000,000 of 4 per cent bonds. Of these, $15,790,000 are to be issued at once and the balance to be reserved for underlying bonds and for future extensions and betterments. The plan also includes a 50-year adjustment mortgage securing an issue of $22,536,000 of 5 per cent income bonds. It also contemplates an issue of $16,590,000 of stock. This makes a total of $39,126,000 of new securities. The stockholders are to pay an assessment of $45 a share, which would yield $7,200,000 in cash. Of the $15,790,000 to be issued at once, the holders of the present 4 per cent bonds, which amount to $37,560,000, are to receive 15 per cent, or $9,390,000, while the stockholders on the payment of their assessment are to receive the remaining $6,400,000 of the bonds. The bondholders are to have full voting power until full interest, including all accumulations, shall have been paid for five consecutive years.

MORGAN MAY ENTER TRACTION FIELD.—The sale by Thomas F. Ryan of his holdings in the Equitable Life Assurance Society to J. P. Morgan has given circulation to reports in the financial district that the latter is about to enter the New York traction field. It is said that Mr. Morgan may probably take a hand in untangling the present traction muddle and reorganizing the properties. In fact, one newspaper has gone so far as to outline a gigantic plan which, it says, is contemplated by Mr. Morgan for the organization of a great holding company to take over all the traction lines in Greater New York and adjacent Long Island and Westchester territory. This project, it is said, includes the McAdoo tunnels and the Steinway tunnel. The entire system, it is said, will be exploited for the purpose of serving the needs of the public and not for the purpose of enriching the insiders. This project, however, lacks confirmation.

WESTINGHOUSE DIRECTORS' MEETING.—The directors of the Westinghouse Electric & Manufacturing Company met Dec. 2, but, according to the statements made, only routine business was transacted. A report was heard from Pittsburgh that Mr. Westinghouse was about to retire from the presidency, but this was specifically denied by Robert Mather, chairman of the board. Mr. Mather said that if any such step was contemplated he had never heard of it. It was also denied that the board had taken any step, or contemplated any, toward paying, in a lump, the remaining back dividends on the preferred stock. It was given out that there would be no deviation from the announced policy of paying these dividends gradually. Another year will be required to clear off these payments under this policy.

McCALL FERRY POWER COMPANY.—The property of the McCall Ferry Power Company was sold Dec. 7 under foreclosure at the court house door, Lancaster, Pa. The property was bid in by the representatives of the bondholders' committee at the upset price fixed by the court. A plan of reorganization has been already formed. The bondholders' committee represented every outstanding bond, therefore the new plan has the unanimous consent of the bondholders.

NEW HAVEN EXTENDS WESTCHESTER TROLLEYS.—The New York, New Haven & Hartford Railroad Company has filed with the clerk of Westchester County, New York, a certificate of incorporation of the Westchester Railroad Company, with a capitalization of $1,000,000. The New Haven road recently bought at foreclosure sale the property of the Tarrytown, White Plains & Mamaroneck Railway Company. The company just incorporated will take over this property and operate the line. There will be no change of route, but the physical condition of the road will be largely improved.

NORTH AMERICAN COMPANY.—C. W. Wetmore has resigned from the presidency of the North American Company and James Campbell, a prominent banker of St. Louis, has been chosen in his place. Mr. Wetmore's resignation was caused by continued ill health. He will remain as a member of the board of directors, and has been appointed its special adviser. Mr. Campbell is one of the leading members of the syndicate which last week purchased control of the "Frisco" Railroad. He has taken an active interest in the affairs of the North American Company for a number of years.

NEW YORK & QUEENS COUNTY RAILWAY COMPANY.—The Public Service Commission of the First District of New York has given out the figures included in the report of the New York & Queens County Railway Company for the year ending June 30, 1909. This report shows that the total revenue from operation was $948,079, and the total expense was $778,457, leaving apparent net earnings of $169,621. The fixed charges on the funded debt and other debts amounted to $258,104, leaving a net corporate loss on the year's operations of $154,158.

FORTY-SECOND STREET LINE TO BE SOLD.—A decree of foreclosure and sale of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway has been ordered by the United States Circuit Court, the judge ruling that, in the event of the failure of the railway company to pay within 20 days $1,676,933, all of the property of the road should be sold on Feb. 1. It is said that more than one-half of the bondholders of the company requested the foreclosure sale.

DIVIDENDS.

American Smelting & Refining Company preferred, quarterly 1¾ per cent, payable Jan. 2; common, quarterly, 1 per cent, payable Jan. 15.

Columbus (Ohio) Railway & Light Company, quarterly, ¾ per cent, payable Jan. 1.

Chicago Telephone Company, quarterly, 2 per cent, payable Dec. 31.

Interborough Rapid Transit Company, quarterly, 2½ per cent, payable Jan. 3.

North American Company, quarterly, 1¼ per cent, payable Jan. 3.

Oklahoma Gas & Electric Company, quarterly, 1¼ per cent, payable Dec. 15.

Portland (Ore.) Railway, Light & Power Company, quarterly, 1¼ per cent, payable Jan. 3.

San Diego (Cal.) Consolidated Gas & Electric Company, quarterly, 1¼ per cent, payable Dec. 15.

St. Joseph (Mo.) Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable Jan. 1.

Washington Water-Power Company, Spokane, quarterly, 1¾ per cent, payable Jan. 3.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Power & Light Company:					
October, 1909	$64,654	$38,992	$25,662	$5,078	$20,584
October, 1908	54,523	38,053	16,470	4,966	11,504
Dallas, Tex., Electric Corporation:					
October, 1909	147,838	80,397	67,441	27,471	39,970
October, 1908	134,140	73,768	60,372	27,554	32,818
Galveston-Houston Electric Company:					
October, 1909	102,014	64,652	37,362	22,486	14,876
October, 1908	94,348	52,843	41,505	20,192	21,313
Massachusetts Electric Companies:					
Year ended Sept. 30, 1909	8,052,355	5,148,390	2,903,958	1,778,128	1,125,829
Year ended Sept. 30, 1908	7,809,010	5,001,517	2,807,492	1,784,437	2,023,054
Minneapolis General Electric Company:					
October, 1909	94,364	37,521	56,843	31,560	25,283
October, 1908	86,679	34,790	51,889	32,596	19,293
Northern Ohio Traction & Light Company:					
October, 1909	184,815	100,800	84,015	44,114	39,900
October, 1908	157,532	90,258	67,274	43,778	23,495
Puget Sound Electric Railway Company:					
October, 1909	170,199	110,591	59,608	49,777	9,831
October, 1908	142,636	91,462	51,174	44,257	6,917
Seattle Electric Company:					
October, 1909	544,077	326,201	217,876	102,169	115,707
October, 1908	401,934	233,624	168,310	97,085	71,225

GENERAL NEWS

Construction News.

FORT PAYNE, ALA.—The City Council has granted a franchise to George H. Edwards, of Birmingham, Ala., to construct and operate an electric light and power plant. A company will soon be formed by the citizens of Fort Payne and Monroe, La. The proposed plant will be operated in connection with the power plant now being installed by the Fort Payne Fuel & Iron Company. The franchise is for a term of five years and under which the company is to furnish the town five arc lamps free of charge. It is understood that work will commence at once on construction of the system. E. C. Drew is president of the Fort Payne Fuel & Iron Company.

GLOBE, ARIZ.—J. B. Girand is reported to be interested in a project to establish an electric street railway in Globe and also a railway to extend from Globe to Miami.

PHŒNIX, ARIZ.—A petition is being circulated in Phœnix, drawn up by a committee appointed by the business men and the officers of the Maricopa County Commercial Club, addressed to the Common Council of Phœnix, asking the Council to request Congress for an authorization of a $200,000-bond issue, the proceeds to be used for the construction of a municipal electric light plant.

WHIPPLE BARRACKS, ARIZ.—The contract for the construction of an electric lighting system at Whipple Barracks, bids for which were opened Nov. 10, was awarded to the Central Electric Company, of San Francisco, Cal., for $12,795. Lieut. William A. Alfonte is constructing quartermaster.

WILLCOX, ARIZ.—It is reported that a power plant will soon be installed at the Mascot Copper Company's mine, near Dos Cobezas.

HOLLYWOOD, CAL.—Bids are being asked for the installation and maintenance of a public lighting system in Hollywood for a period of years. George H. Field is city clerk.

MARYSVILLE, CAL.—The trustees of Reclamation District No. 70, of Sutter County, have awarded a contract for the installation of a new motor and entire electrical equipment, including the transformer, for the large drainage pump of the district. The contract price was $3,650. The Pacific Gas and Electric Company is erecting a new electric line from Marysville to Meridian, a distance of 20 miles, which will furnish the district with electricity for the operation of the pumping plant. The new transmission will also furnish electrical service to all residents of the district along the route.

MERIDIAN, CAL.—The Trustees of Reclamation District No. 70 have awarded a contract for the installation of a 150-hp motor with complete electrical equipment and a 30-in pump for the seepage water pump in the district to Fairbanks, Morse & Company, of San Francisco. Cal.

MONTEREY, CAL.—The Supervisors have granted a franchise for a transmission line between Salinas and Monterey to the Monterey Gas & Electric Company, for which it paid $100.

PASADENA, CAL.—The City Council has established a new rate for electrical energy, making the price three cents per kw-hour to consumers using over 2000 kw per month furnished by the municipal electric light plant. This is said to be the lowest rate for electrical service in the United States. C. W. Koiner is general manager.

REDDING, CAL.—W. P. Hammon is reported to have acquired two valuable water rights in the eastern part of Shasta County, and it is predicted that another electric power development on a large scale will soon come to the surface. Mr. Hammon is the head of a power development project at Lake Tahoe. W. W. Brown, who owned 1,160 acres on Hat Creek, near the town of Cassel, a few months ago, sold his tract for $15,000. The Brown land includes a lake called Brown's Lake, and the property carries with it 8000 in. of water that originates in springs on the land. It is learned from San Francisco that J. S. Frick, of Redding, who has spent several months at the bay, has closed a contract to sell 40,000 inches of Hat Creek water to Mr. Hammon for $65,000. Two small payments have been made to bind the contract. The whole amount is to be paid by Jan. 1, or as soon as the titles are cleared up in the Probate Court. The Frick water right adjoins Brown's on the north, and is valuable, because 187 ft. fall can be secured in less than half a mile. By building a 75-ft. dam on the Brown property, a large storage reservoir of 600 or 700 acres can be formed.

SACRAMENTO, CAL.—Bids will be received at the office of M. J. Desmond, city clerk, for lighting the streets and departments of the City of Sacramento for a term of one year from Dec. 31, 1909.

SACRAMENTO, CAL.—Judge James A. Waymire is working on a project to irrigate the northeastern portion of Sacramento County. It is proposed to build a large dam at Auburn, near the entrance of Truckee River. The water will be brought from Lake Tahoe in conduits, which will have a carrying capacity of 500,000,000 gal. daily. The work will also include the cutting of a tunnel five miles long through the mountains. In the course of the canal or conduit to the Auburn reservoir, sufficient fall will be secured to generate electricity to the extent of 230,000 hp. There will be five falls, the first of which will have a drop of 900 ft.; second fall, 400 ft.; third fall, 1,500 ft.; fourth, 700 ft., and fifth, 500 ft. A company will be organized capitalized at $50,000,000 to carry out the project.

SAN BERNARDINO, CAL.—Arrangements are being made by the Arrowhead Reservoir Company for the construction of its large tunnels which are to connect the Deep Creek reservoirs with the main reservoir in Little Bear Valley. The work will be done by the company direct instead of by contract. Preparations are being made for the erection of a transmission line to transmit electricity across the crest into Little Bear and Deep Creek country to operate the drills. It is understood that the Arrowhead company has entered into a contract with the Edison Electric Company to furnish electrical energy for the work. V. C. Smith is general manager of the Arrowhead Reservoir Company.

TEHACHAPI, CAL.—S. A. Barrett, of Los Angeles, Cal., has been making investigations in Tehachapi with a view of furnishing electricity in the town for lamps and motors.

VALLAJO, CAL.—We are informed that work will commence next year on the construction of the Vallejo & Northern Railroad, which will extend from Sacramento to Woodland, Davis, Suisun, Vacaville, Fairfield, Dixon, Winters and Vallejo, a distance of 110 miles. The overhead trolley system will be used on the city lines and the third rail on the interurban lines. The company is capitalized at $2,500,000. T. T. C. Gregory, of Fairfield, is president.

VISALIA, CAL.—The California Hot Springs Company has filed a notice of appropriation of 1000 miners' in. of water in Deer Creek to be utilized for generating electricity and for irrigation purposes, etc.

DENVER, COL.—Plans have been practically completed for the reorganization of the Denver Gas & Electric Company and will be submitted to Henry L. Doherty, president, for approval. The certificate of the incorporation of the new company, the Denver Gas & Electric Light Company, with an authorized capital stock of $10,000,000, has been filed with the Secretary of State. The new company will operate the local steam heating system, which will be thoroughly remodeled. A bond issue to the amount of $25,000,000 has been authorized to take care of improvements and extensions that would be required for a number of years. It is estimated that improvements to the steam heating plant will cost about $750,000.

GRAND JUNCTION, COL.—Preparations are being made by the Grand Junction Street Railway Company for the construction of an electric railway to Fruita, a distance of 15½ miles. Electric locomotives will be used; electricity for operating the railway will be secured from the Grand Junction Electric, Gas & Manufacturing Company. Thomas E. Curtin is president of the company, and E. A. Sunderlin general manager, both of Colorado Springs, Col.

LEADVILLE, COL.—The Leadville Light & Power Company is reported to be extending its transmission lines to the Sugar Loaf mining district to supply electricity in that district for lamps.

BRIDGEPORT, CONN.—Plans are being prepared by the Locomobile Company of America for an addition to its plant at Seaside. The installation of a turbine unit is under consideration.

NEW MILFORD, CONN.—The plant and holdings of the New Milford Electric Light Company have been purchased by Verton P. Staub and E. J. Emmons, representing local business men. The new owners are planning to establish a 24-hour service and will also furnish electricity for both lamps and motors. At present the company only furnishes a lighting service. The price paid for the plant is said to have been about $75,000.

CLARKESVILLE, GA.—It is reported that the Clarksburg Railway Company will enlarge its power plant upon completion of its proposed extension to Nacoochee Valley. The installation of a turbine unit is under consideration.

WEISER, IDAHO.—The Lewishon Brothers, who have purchased the Iron Dyke property in the Seven Devils district, it is said, contemplate the construction of a smelter near Ballard's Landing on the Snake River to handle the ore from their mines and other mines in that district, and will also build an electric line from the Seven Devils district down the Snake River from Huntington to Lewiston. It is reported that they have also secured an option on the Ox River electric project on the Snake River near the proposed site of the smelter. The electric power plant when completed will have an output of about 30,000 hp. A tunnel 35 ft. in circumference is being driven through solid rock for 2000 ft., which will change the channel of the river. Work has been in progress more than three years and the total cost of the work is estimated at $3,000,000.

ALTON, ILL.—Preparations are being made by the Alton Tool Handle Company to remodel its plant and equip it for electric motor drive throughout.

EASTON, ILL.—Plans are being considered by several rural telephone companies which run into Easton to consolidate and operate an

exchange. It is proposed to organize a company and install a switchboard and other equipment. Considerable improvements will be made to country lines. J. F. McKinley was appointed president; C. W. Kennedy, secretary, and A. Tomlin, treasurer.

BLUFFTON, IND.—The directors of the Bluffton, Geneva & Celina Traction Company have decided to install the overhead trolley system. The use of self-contained motor cars had received serious consideration.

BRISTOL, IND.—The St. Joseph Valley Traction Company, of Elkhart, has been granted a franchise by the Trustees to build an electric railway through Bristol. H. E. Bucklen is president.

DECATUR, IND.—We are informed that the Fort Wayne & Springfield Railway Company expects to construct 28 miles of track during the coming year. W. H. Fledderjohann is general manager.

EVANSVILLE, IND.—It is reported that the Evansville Railways Company, which operates traction lines from Evansville to Newburg and Rockport, Ind., will extend its system across the Ohio River to Henderson and Owensboro, Ky.

EVANSVILLE, IND.—C. A. Gillham, secretary and general manager of the Central Station Engineering Company, is representing an applicant for a franchise to establish a central heat, light and power plant, which proposes to erect a system in Evansville to cost about $1,000,000. The Board of Public Works is now considering the proposition submitted to the Council.

INDIANAPOLIS, IND.—Plans are being made by the Star Motor Company for the construction of a factory in Indianapolis, Ind., including the installation of a power plant. The plant will be equipped with electric motor-driven machinery.

SOUTH BEND, IND.—The City Council has passed a resolution ordering all electrical wires placed underground, giving the companies four years to do the work.

SYRACUSE, IND.—The hydroelectric power plant of the Syracuse Electric Power Company, located on the Elkhart River, six miles from Syracuse, has been completed. The company has erected transmission lines from the plant to Syracuse, Milford and Benton, 17 miles in length, to supply electricity for lamps and motors to these towns, and also to furnish electrical service to the farmers along the line. J. S. Neff is interested in the company.

DAVENPORT, IA.—A special meeting of the stockholders of the Davenport & Manchester Interurban Railway Company will be held at Monticello on Dec. 14 to vote on the proposition to increase the capital stock of the company to $650,000. The company proposes to construct an electric railway from Davenport to Manchester.

LEON, IA.—The Leon Light, Heat & Power Company has filed amendments to its charter, changing its name to the Leon Electric Company and increasing the capital stock of the company from $15,000 to $30,000.

MASON CITY, IA.—The Mason City & Clear Lake Railway Company will soon place contracts for a 500 or 600-kw, 2300-volt, 60-cycle, three-phase generator, a simple Corliss engine and a 500-kw, 600-volt rotary converter.

OSKALOOSA, IA.—Col. T. P. Spillman, of Ottumwa, Ia., is reported to be interested in the construction of an electric railway extending from Oskaloosa to Ottumwa, for which most of the right of way from Ottumwa to Eddyville, via Kirkville, has been secured.

THURMAN, IA.—The Malvern Light & Power Company is reported to have submitted a proposition to the town officials offering to extend its transmission from Tabor to Thurman, providing a 20-year franchise is granted and the town agrees to enter into a contract with the company to furnish 30 incandescent lamps of 32 cp for street lighting at $1.25 per lamp per month and the people of Thurman to take $5,000 in bonds.

KANSAS CITY, KAN.—Sealed bids will be received at the office of the purchasing agent of the City of Kansas City until Dec. 23 for one 15-ton electric traveling crane and one 15-ton automatic air lift, to be installed at the Turkey Creek pumping station of the Kansas City water works, specifications for which will be furnished on application. E. Winstanley is purchasing agent.

COVINGTON, KY.—The Cincinnati, Louisville, Lexington & Maysville Traction Company has applied to the City Council for a franchise over the streets of the city necessary to secure an entrance through the town to the river.

COVINGTON, KY.—Application has been made to the City Council by the Covington & Big Bone Railway Company for a franchise to construct an electric railway through certain streets in the city for interurban service; also to operate a trunk line over other streets, which will give an entrance for its railway connecting Covington and Big Springs.

LOUISVILLE, KY.—The Kentucky Electric Company is planning to make improvements to its plant in this city, which will involve an expenditure of about $40,000. The company proposes to secure its water supply from the Ohio River and will construct a pipe line 150 ft. in length into the river. The contract for the work has been awarded to the Falkenau Electrical Construction Company, of Chicago, Ill.

LAKE CHARLES, LA.—It is reported that the Lake Charles Railroad & Navigation Company is contemplating the construction of an electric railway from Edna to Kinder, La., six and one-half miles in length.

NEW ORLEANS, LA.—Plans are being made by the stockholders and bondholders of the Consumers' Electric Company to reorganize the company and take it out of the receiver's hands. It is proposed to organize a new company to take over the plant and holdings. The business of the company has increased to such an extent under the administration of the receiver that it is necessary to enlarge the plant, which, it is said, will require an expenditure of about $1,000,000. Samuel Insull, president of the Commonwealth Edison Company, is receiver.

PLAQUEMINE, LA.—The franchise and property of the Plaquemine Electric Light & Power Company was sold at auction on Nov. 27 to Attorney J. H. Pugh, for $8,500. There are judgments against the company for $13,000. The buildings and equipment of the company was destroyed by fire Nov. 1. It is understood that a new company will be organized.

RAMSAY, LA.—It is reported that the Greenlaw Lumber Company is installing an electric light plant.

PORTLAND, MAINE.—Bids for electric work and ventilating and heating the new city hall (which were opened Dec. 1) were rejected and new bids for the work will be solicited. Carrere & Hastings, 225 Fifth Avenue, New York, N. Y., and John Howard Stevens, 187 Middle Street, Portland, Maine, are architects. A. L. T. Cummings is city clerk.

WATERVILLE, MAINE.—The Messalonskee Electric Company, of Waterville, which has purchased the water privilege of Besse & Morrison, located about 1½ miles from Clinton, Maine, is making preparations for cutting a canal and building a concrete dam.

ESSEX, MASS.—The question of lighting the streets by electricity is under consideration. It is said that a proposition has been submitted to light the entire town by the installation of 100 lamps for $1,600 per year. The town now pays $400 per year for the care of 30 lamps lighted 20 nights in the month.

PITTSFIELD, MASS.—The Pittsfield Electric Company is reported to be considering the question of increasing the output of its plant at Silver Lake.

SPRINGFIELD, MASS.—Sealed proposals will be received by the Municipal Building Commission, Municipal Building, Springfield, Mass., until Dec. 22, as follows: Contract No. 3—Heating and ventilating; Contract No. 4—Electric work; Contract No. 5—Plumbing for the auditorium, tower and passage and municipal office building of the new municipal buildings to be erected by the City of Springfield, in Court Street, facing Court Square. Copies of drawings and specifications may be seen at the Municipal Building, at the office of the architects, Pell & Corbett, 122-124 East Twenty-fifth Street, New York, N. Y., or at the office of Hollis French & Allen Hubbard, Albany Building, Boston, Mass., copies of which may be obtained by application to any of the above parties; a deposit of $25 will be required for each set of plans and specifications for any one of the contracts, of which $15 will be refunded on return of the plans in good condition. George Dwight Pratt is chairman Municipal Building Commission.

WORCESTER, MASS.—The contract for electric wiring of the independent industrial school has been awarded to the Coghlin Electric Company for $1,475.

DETROIT, MICH.—Plans are being considered by the Detroit Copper & Brass Rolling Mills for increasing the equipment of its power plant, which will include the installation of alternating-current generators with a rating of about 1500 hp with auxiliary apparatus. The plant will be driven by steam turbines.

GRAND RAPIDS, MICH.—Bids will be received at the office of the Board of Public Works until Dec. 16 for furnishing and erecting mechanical furnace equipments for two boilers at the combination pumping and lighting plant in the City of Grand Rapids, Mich., in accordance with plans and specifications on file at the office of the board. All proposals must be made upon blanks furnished by the board. William M. Gormley is president.

HANCOCK, MICH.—The Board of Public Works has recommended to the City Council the purchase of a pumping engine or a centrifugal pump, motor driven, in connection with the water works system.

LAINSBURG, MICH.—J. Naldrett has submitted a proposition to the village authorities offering to furnish electricity to light the streets of the village. He proposes to furnish 40 lamps for $900 per year.

MINNEAPOLIS, MINN.—Bids for wiring the Seward and Seven Oaks School buildings (which were opened Nov. 30) were rejected. Plans for the work will be revised. W. G. Nye is secretary Board of Education.

THIEF RIVER FALLS, MINN.—The Northwestern Telephone Company has applied to the City Council for a franchise to erect and operate a telephone system in Thief River Falls.

JACKSON, MISS.—The plant and holdings of the Jackson Electric Railway, Light & Power Company, owned by Frank Jones and Gen. Carnes, of Memphis, Tenn., have been taken over by F. B. Prout and H. H. Carson, of the General Electric Company and local capitalists. The price paid for the property was about $1,000,000. The company operates about seven miles of track and furnishes electricity for lighting the streets of the city. Thomas McClelland, it is said, will be president and Mr. Prout, general manager.

BUTLER, MO.—We are informed that the city is in the market for a 50-kw, 125-250-volt, three-wire, direct-current unit with an automatic direct connected steam engine, switchboard, instruments, etc., complete,

for the municipal electric light plant. A 250-volt unit with balancing set could be used, new or second hand. For further information address H. M. Cannon, superintendent.

FERGUSON, MO.—The City Council has decided that the King Electric Light & Power Company, of St. Louis, Mo., which furnishes electrical service in Ferguson, must reduce the price of electricity from 15 to 10 cents per kw-hour or forfeit its franchise, the new rate to take effect from Dec. 1, 1910.

JEFFERSON CITY, MO.—The Big Naunga Power Company, recently incorporated, is reported to be contemplating the construction of a hydroelectric power plant in Jefferson City. A dam will be constructed at a cost of from $35,000 to $45,000, which will develop from 1600 to 2000 hp. I. Phillips, of Buffalo, Mo., is president.

CLAY CENTER, NEB.—M. M. Johnson, of this city, is installing an electric light plant, which will be operated in connection with his factory. Larger engines are now being installed to furnish power for the system. The distributing system is nearly completed, for which a franchise was secured from the town sometime ago. It is expected that electrical service will commence within 30 days.

NEBRASKA CITY, NEB.—At a special election held recently the citizens voted in favor of the proposition to give the Nebraska City Water & Light Company a 20-year franchise and a contract to supply the city with water and for lighting the city for a term of ten years. The company has agreed to extend its water and lighting systems to all parts of the city not having lighting service and to expend from $40,000 to $50,000 in improvements.

CLAREMONT, N. H.—The Monadnock Cotton Mills are installing a hydroelectric power plant with a rating of 850 hp, in two units, the power to be utilized to operate the mills.

MEREDITH, N. H.—Improvements are being made to the power plant of the Meredith Linen Mills, which include the installation of a new pipe line, a pair of S. Morgan Smith water wheels, which will operate the linen mills and also a small generator, which will furnish electricity to run motors in a wood-working plant.

NEWARK, N. J.—Plans are being considered by the Pennsylvania Railroad Company for the construction of a new branch road to extend from Park Place, Newark, to Harrison, N. J. The tracks from Harrison to Jersey City will be equipped for electrical operation, and a direct track connection made with the Hudson & Manhattan Railroad, east of the Marion station, Jersey City.

PRINCETON, N. J.—Plans are being considered by the Borough Council for improving the lighting system of the borough. It is said that municipal ownership is under consideration. Prof. Howard McClenahan, of Princeton University, is consulting engineer.

BROOKLYN, N. Y.—Sealed proposals will be received by Bird S. Coler, borough president, until Dec. 15 for gas and electric fixtures for the public bath located at Fourth Avenue and President Street, Borough of Brooklyn, N. Y. Blank forms and further information may be obtained and plans and specifications can be seen at the office of the Bureau of Public Buildings and Offices, Municipal Building, Borough of Brooklyn, N. Y.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company is contemplating extensive developments to its system, which will involve an expenditure of about $50,000,000. The plans contemplate the following extensions: To equip and operate the Fourth Avenue subway; to extend its Fifth Avenue elevated railway as an elevated road to Fort Hamilton; to elevate its West End line from Coney Island to Eighteenth Avenue, and depress the tracks from that point north to Forty-second Street, where they will run into the Fourth Avenue subway; to elevate its Sea Beach road from Coney Island to the point where it joins the West End line; to elevate its Culver line its entire length; to extend its Brighton Beach division, as already announced, by subway to Flatbush Avenue and Fulton Street and thence via the Fourth Avenue subway, the Manhattan Bridge and the Canal Street subway to Manhattan, to a loop at the North River; to third track its Fulton Street line; to third track its Lexington Avenue line; to third track its Broadway line; to make various extensions to its elevated system in the eastern district with a view to furnishing the East New York and Ridgewood sections with a much better transportation service than at present exists.

GLOVERSVILLE, N. Y.—The Fonda, Johnstown & Gloversdale Railroad Company has decided to equip the section of its steam railroad lying between South Main Street, Gloversville and the fair grounds crossing, in Johnstown, to be operated by electricity.

KINGS PARK, N. Y.—Bids will be received by the State Commission in Lunacy, Albany, N. Y., until Dec. 15 for the construction of a power plant, connecting mains, electric feeder cables to laundry, transformers and distributing board at the Kings Park State Hospital, Kings Park. Plans and specifications may be seen and blank form of proposal obtained at the Kings Park Hospital, Kings Park, N. Y.; at the office of the State Commission in Lunacy, 1 Madison Avenue, New York, N. Y., and at the office of the state architect. T. E. McGarr is secretary of commission.

NEW YORK, N. Y.—The Board of Estimate and Apportionment has adopted a resolution requesting the Public Service Commission to prepare plans for the construction of a moving platform railway under Thirty-fourth Street extending from Ninth to Second avenues.

NEW YORK, N. Y.—Bids will be received by John H. O'Brien, Commissioner of Water Supply, Gas and Electricity, 21 Park Row, New York, N. Y., until Dec. 14 for furnishing materials and installing two direct connected electrically driven vertical pumping units, complete with all appurtenances, including electric lighting installation in the pumping station to be erected for the sewage disposal plant in Mount Kisco, N. Y. Further information may be obtained upon application to the chief engineer, Room 922, 21 Park Row, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Dec. 13 for furnishing all labor and materials required for completion of a hospital pavilion, including lighting, fixtures and all other work in connection with the New York City Home for the Aged and Infirm, Blackwells Island, N. Y. Blank forms and further information may be obtained at the office of Raymond F. Almirall, architect, 51 Chambers Street, New York, N. Y., where plans and specifications can be seen. Robert W. Hebberd is commissioner.

SENECA FALLS, N. Y.—The Geneva & Auburn Railroad Company is contemplating the construction of a power plant with an output of about 1500 hp to furnish electricity to operate a 15-mile extension.

DANBURY, N. C.—We are informed that contracts will be placed by the North Carolina Traction Company within 60 days for the construction of 80 miles of railway. The Traction company is successor to the Crescent Electric Railway Company. E. Hillman is president of the Traction company.

BOWLING GREEN, OHIO.—Orders have been placed by the Lake Erie, Bowling & Napoleon Railway Company for rails to be used for the proposed extension of its railway.

CINCINNATI, OHIO.—The Ohio Electric Railway Company has commenced work on the overhead system of the old Columbus & Lake Michigan Railroad between Lima and Defiance. The company states that steam will be used for hauling freight, and electricity for passenger service.

CLEVELAND, OHIO.—An ordinance granting the Cuyahoga Light Company to extend its heating and lighting system throughout the entire downtown section of the city and easterly to East Fortieth Street has been submitted to the City Council. It is said that the company will commence work on the construction of a large plant on the lake front, to cost $1,000,000, as soon as the ordinance is passed. At present the company's service only extends as far east as East Twentieth Street and is confined to Prospect Avenue alone for the greater part of the distance. A clause in the ordinance makes it possible for the company to make extensions in any direction from this territory. It has only certain rights in the downtown section. Under the ordinance the company is permitted to charge the rate of 5½ cents per kw-hour for electricity, and provision is made giving the Council the right to regulate prices in accordance with the law. It is also stipulated in the ordinance that the Cuyahoga Light Company shall forfeit all rights if it should consolidate or merge in any way with the Cleveland Electric Illuminating Company without permission of the Council. John C. Keys is president of the Cuyahoga Electric Company.

ENID, OKLA.—Application has been made to the City Council by L. J. Downey for a franchise to construct and operate an electric light plant in Enid.

LAWTON, OKLA.—At a recent election the citizens voted to grant a franchise to the Lawton & Fort Sill Electric Railway Company, which proposes to construct and operate a street railway system in Lawton and an interurban line to Fort Sill and Medicine Park, a distance of 20 miles. The company has just purchased property in Medicine Park, in the Wichita Mountains, which it proposes to develop for a pleasure resort. The War Department has granted the company right of way through the Fort Sill military reservation for its proposed electric railway.

POTEAU, OKLA.—C. F. Eshelman, manager of the Poteau Light & Ice Company, writes that as yet no definite plans have been made for the construction of its proposed light and ice plant.

RALSTON, OKLA.—Bids will be received until Dec. 15 for furnishing material and construction of a complete electric light plant and water works system for Ralston. The work will include well, building, triplex power pumps, alternating-current dynamo, oil engine, steel tank and tower, poles, wire, cast iron pipe, etc. Bids will also be received at the same time for the purchase of $25,000 in bonds. M. A. Earl & Company, of Muskogee, Okla., are engineers. T. E. Bryant is city clerk.

OREGON CITY, ORE.—Surveys are being made for the construction of an electric railway from Oregon City to Silverton. F. M. Swift is reported to be interested in the project.

CHAMBERSBURG, PA.—We are informed that improvements will be made to the municipal electric light plant, bids for which will be received until Dec. 23. The cost of the work is estimated at about $25,000. J. H. Mowrey, of Chambersburg, Pa., is chief engineer.

CONSHOHOCKEN, PA.—Preparations are being made by the Schuylkill Valley Traction Company to reconstruct its system through Conshohocken during the coming year, preparatory to an extension of its tracks to Spring Hill. George Hoeger, of Norristown, Pa., is general manager.

DUQUESNE, PA.—The Duquesne & Dravosburg Street Railway Company has awarded contracts for all material for its proposed electric railway, with the exception of overhead material. Electricity for operating the system will be purchased for the present. The proposed

railway will extend from Duquesne to Dravosburg, via Duquesne Annex and Mifflin Township, a distance of three miles.

EAST GREENWICH, PA.—The Borough Council has granted W. R. Chapin, of Wyoming, Pa., a franchise to construct and operate an electric light plant in East Greenville.

GROVE CITY, PA.—Preparations are being made by the Slippery Rock & Grove City Street Railway Company to commence work about the first of the year on its proposed railway between Grove City and Slippery Rock, a distance of nine miles. The capital stock authorized is $55,000. Application will be made at once to increase it to $250,000. H. B. Graves, of Butler, Pa., is chief engineer.

PHŒNIXVILLE, PA,—The construction of an electric railway from Phœnixville to Strafford, a distance of ten miles, is under consideration. Thomas E. O'Connell, of West Chester, Pa., is reported to be interested in the project.

PITTSBURGH, PA.—The Jones & Laughlin Steel Company, which has recently placed large orders for generating machinery for its new plant at Aliquippa, it is said, will purchase motors and other equipment for electric motor-driven machinery.

PITTSBURGH, PA.—Proposals will be received at the office of the controller until Dec. 10 for the gas and electric light fixtures for men's dormitory and buildings 1, 2 and 3 of administration group of the Allegheny County Home, at Woodville, Pa.; also for a telephone system for same buildings. Plans, specifications and blank forms of proposals may be obtained at the office of Andrew McMaster, architect, Curry Building, Four Avenue and Ross Street, Pittsburgh, Pa. R. J. Cunningham is county controller.

SCRANTON, PA.—Among the improvements contemplated by the Scranton Electric Company during the coming year, besides the construction of a central power plant mentioned in the issue of Dec. 1, include an addition to the Suburban plant located on North Washington Avenue for the installation of a new switchboard, engines and generators, and a 5000-kw steam turbine. The company also contemplates tearing down the Dix Court power house and erecting a steel building; the output of the plant has recently been increased from 800 to 1600 hp by the installation of two new engines; a new switchboard is now being installed. At the Lackawanna River plant a 300-hp engine is being installed and a new pump house erected. L. H. Conklin is general manager.

YORK, PA.—Only one bid was received by the City Council for lighting the streets of the city, which was submitted by the Edison Electric Light Company, in which the company asks $60 per year for each arc lamp, which is $11 more than the city is now paying. The company also refuses to sign a contract for less than five years. The Council considers the bid excessive and has instructed the light committee to secure estimates on the cost of the construction of a municipal electric light plant and to compare the cost of street lighting in York with that of other cities.

PEACE DALE, R. I.—The Peace Dale Manufacturing Company is installing a 900-kva, low pressure steam turbo-generator set to furnish electricity for operating the electric motor-driven machinery in its plant.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has purchased a site on Bough Street in the Olneyville district, on which it will erect a substation for the distribution of electricity throughout the district.

WOONSOCKET, R. I.—The Woonsocket Electric Machine & Power Company has secured a contract from the Town Council of North Smithfield for lighting the streets of that town for a term of one year. The contract calls for 40 incandescent lamps to be placed in different parts of the town.

GREENVILLE, S. C.—Plans are being considered by the Union Bleaching & Finishing Company for improvements to its plant, including the installation of additional machinery, and changing the motive power of its works from steam to electric motor drive. Electricity will be secured from the Greenville transmission system of the Southern Power Company.

GREENVILLE, S. C.—The interurban line to be built by the Duke interests, starting with the recently acquired lines of the Anderson Traction Company, will be known as the Greenville, Anderson & Spartanburg Railway, the distance between each town being about 35 miles, Greenville being at the apex of the triangle formed by the three towns. It is reported that the system will be extended northeast to Charlotte and Greensboro, 200 miles distant.

ABERDEEN, S. D.—Plans are being made by the Aberdeen Street Railway Company for the construction of a local street railway system, contract for which will be awarded during the winter. The proposed railway will be four miles in length. As yet no definite arrangements have been made for securing electricity to operate the railway. C. N. Herrick is president.

RAPID CITY, S. D.—The Rapid City Electric Light Company is reported to have been reorganized and it is proposed to extend and improve the system.

HENNING, TENN.—Preparations are being made by J. R. Gregory, J. B. Alston and J. W. Wilson for the construction of a 30-kw electric light plant and a 10-ton ice plant. Plans as yet have not been completed.

ANGLETON, TEX.—E. M. Masterson is reported interested in a project to establish an electric light plant in Angleton, Tex.

MINERAL WELLS, TEX.—The contract for the construction of an interurban railway from Fort Worth to Mineral Wells has been signed by the interurban committee of this city, and Judge James A. Watkins and Paul Hurley, promoters of the Mineral Wells & Northwestern Railway Company, which was recently chartered for the purpose of constructing the railway.

MT. PLEASANT, TEX.—The Gilmer Telephone Company has been granted a franchise by the City Council to erect telephone wires in Mt. Pleasant.

PORT ARTHUR, TEX.—Bids have been asked by the Port Arthur Traction Company for the construction of the road bed for its proposed railway from the city limits along the Seventh Street road extension to the docks and the Gulf Refining Company. The road will be built on private right of way.

SALT LAKE CITY, UTAH.—C. J. Petgen, of Pittsburg, Pa., has filed application with the state engineer for permission to appropriate ten second ft. of water from the Cottonwood Creek, in Plute County, to be utilized to generate electricity.

SALT LAKE CITY, UTAH.—Plans are being considered by Mayor John S. Bransford for the construction of a municipal electric light plant, to cost at least $50,000. It is proposed to establish the plant at or near Parley's Canyon reservoir, which will supply electricity for operating the pumps at the sewage plant at Seventh North and Eighth West Streets to the intercepting sewer, also for lamps in the business district. It costs the city $60,000 per year to light the city under the present contract with the Utah Light & Railway Company, and it is estimated that it will cost the city about $15,000 for power to operate the sewage pumping plant.

NORTHFIELD, VT.—Preparations are being made to extend the municipal electric light system to Northfield Junction to furnish electricity for lamps. Several residences and the Davis woolen mill will install electric lamps, and it is expected that street lamps will also be installed.

BEDFORD CITY, VA.—The Town Council has decided to call an election Dec. 29 to vote on the proposition to issue $95,000 in bonds, the proceeds to be used for the construction of a hydroelectric power plant on James River.

KIMBALL, VA.—Surveys have been completed by J. S. Shaw, of Algoma, W. Va., for the proposed electric light plant and water-works system to be established in Kimball. Work will commence at once on construction of the plants. L. Kaufman, of Northport, will do the construction work. The cost of the work is estimated at $100,000.

RICHMOND, VA.—The sum of $600,000 will be expended in general improvements by the Virginia Railway & Power Company, of Richmond, according to an announcement made public by President Northrup, which will include a new terminal station in Manchester, across the James River from Richmond, and the installation of new high-speed motor equipment for the Richmond-Petersburg 30-mile interurban railway, with terminals in Manchester. Terminal improvements in Richmond are to be included, also the purchase of new cars for local use and other railway equipment and betterment of service.

ROMNEY, W. VA.—The Boston Water Development Company is reported to be interested in the construction of a hydroelectric power plant. Richard F. Barrey is president of the company.

MABTON, WASH.—The Yakima Valley Power Company is reported to have been granted a 15-year franchise by the City Council to install an electric light plant in Mabton.

NORTH YAKIMA, WASH.—The City Council has decided to purchase the electric light plant and water works system of the Northwest Light & Water Company in North Yakima, for $310,000.

SEATTLE, WASH.—The Union Pacific Railroad Company is reported to have purchased the Puget Sound Electric Company's Seattle-Tacoma railway as a part of an electric railway system to be establihsed in the Northwest.

TACOMA, WASH.—The Commissioner of Public Works has asked the City Council to advertise at once for bids for the construction of the power canal and headworks of the proposed municipal electric plant on the Nisqually River. The plant when completed will cost about $2,000,000.

TUMWATER, WASH.—The Tumwater Power Company has offered to furnish several arc and tungsten lamps to the city free of charge, the location of the lamps to be decided upon by the City Council. L. F. Schmidt is interested in the company.

BELLEVIEW, W. VA.—Contracts have been awarded by the Fairmont & Northern Railroad Company for the construction of an electric railway from Belleview to Amos, W. Va., a distance of 12 miles.

KENOSHA, WIS.—Robert D. Wynn, vice-president of the Central Engineering & Construction Company, which has charge of the construction of a belt of electric railways in Northern Illinois and Southern Wisconsin, has presented a proposition to the City Council for the construction of a new electric railway into Kenosha in order to connect with the electric railways now honeycombing the northern part of Illinois. If the proposition meets with the approval of the citizens it is proposed to apply to the Wisconsin Railway Commission for a certificate of necessity and convenience for building a railway to be known as the Kenosha, Rockford & Elgin Electric Railway Company.

LAKE MILLS, WIS.—The question of purchasing the plant of the Creamery Package Company, to be used as a municipal lighting plant, is under consideration. A special election will be held to submit the proposition of the people.

MADISON, WIS.—Application has been made to the State Commission for a certificate of convenience and necessity in connection with a proposed electric interurban railway between Madison and Janesville, Wis. A company composed of local and New York capitalists has acquired control of the Janesville Street Railway Company, which, with its present Rockford and Beloit interurban systems, will give it an electric interurban service between Madison, Wis., and Chicago, Ill. The price paid for the Janesville street railway was about $45,000.

MILWAUKEE, WIS.—The Council joint committee on health and street lights has decided to recommend to the Council the employment of the Power Improvement Company, at a cost of $400, to investigate not only all the uses to which the surplus power of the new garbage plant can be put, but the utilization of surplus power from all city heating and lighting plants.

PORTAGE, WIS.—The Southern Wisconsin Power Company is erecting a substation in Portage at a cost of about $40,000, which will be used for the distribution of electricity generated at the Kilbourne dam.

LARAMIE, WYO.—The plant and holdings of the Laramie Light & Power Company is reported to have been purchased by Denver capitalists. The company has the contract for lighting the streets and public buildings and does a large commercial business. W. C. Parrish will be retained as superintendent.

FRANK, ALTA, CAN.—The Canadian-American Company is planning to install an electric power plant at its works in Frank. The plant will be driven by gas engines, the engines to be operated by waste gas from the coke ovens.

BURNABY, B. C., CAN.—The British Columbia Electric Railway Company has asked the Town Council that it be allowed the option to build an electric railway north of Burnaby Lake.

NEW WESTMINSTER, B. C. CAN.—Notice of application of 1200 cu. ft. of water rights of the Marquam River, to be utilized for power purposes, has been filed by C. T. Dunbar, of Vancouver, B. C. It is said that Mr. Dunbar proposes to organize a company to develop the water power to generate electricity.

PRINCE RUPERT, B. C., CAN.—The electric lighting plant and saw mill at Seal Harbor, owned and operated by the British Columbia Tie Timber Company, was destroyed by fire on Dec. 3. The total loss is $60,000, covered by insurance. The plant furnished electricity in Prince Rupert.

CORNWALL, ONT., CAN.—An agreement has been entered into between Cornwall Township and the Cornwall Electric Street Railway Company, whereby the company receives a franchise to extend its railway up the West Front Road over Wood's Hill to the Ontario & New York Railway depot.

HAMILTON, ONT., CAN.—The City Council has decided to enter into a contract with the Hydro-Electric Power Commission to supply the city with 1000 hp.

LONDON, ONT., CAN.—The Canadian Westinghouse Company has been awarded the contract for the electrical apparatus for the municipal electric lighting system, amounting to $50,908. The total amount of the bid of the company was $64,058, which included one motor-generator set and street arc lighting system, awards for which have been deferred.

LONDON, ONT., CAN.—The City Council on Dec. 1 ratified the agreement with the London Electric Light Company providing for a continuation of the street lighting at the old rate of 23 cents per lamp per night, until the municipal distribution plant is ready to light the streets with Niagara power next year. The agreement, however, provides that in case the city does not take the company's service for a full year that a sliding scale shall be paid according to the proportion of the year for which the company furnishes the service.

PORT ARTHUR, ONT., CAN.—The injunction to restrain Port Arthur from entering into a contract with the Hydro-Electric Power Commission has been made permanent. The injunction was secured on the ground that the proceedings to commit the town to the contract has been irregular and contrary to law and not because it was an unwise undertaking.

STRATFORD, ONT., CAN.—The report of the three arbitrators appointed to appraise the value of the Stratford electric lighting plant has been received by the city authorities. The amount is fixed at $58,800, consisting of $43,800 for plant and $15,000 for good-will The latter is based on the average yearly profit of $5,324. Accordingly, a bylaw will be submitted to the ratepayers at the January municipal elections to raise this amount in order that the city corporation may take over the plant and business from the Stratford Gas Company.

WINDSOR, ONT., CAN.—The Sandwich, Windsor & Amherstburg Railway Company will soon place orders for two 500-kw, three-phase, direct-connected alternators, and also two 750-hp engines. James Anderson is general manager.

SHERBROOKE, QUE., CAN.—A proposition has been submitted to the City Council by W. Hibbard, of Montreal, Que., representing a new company, in regard to securing control of the local street railway. It is proposed to extend the railway throughout the city and ultimately to Magog. The new company wishes to purchase the Westbury Basin power rights, now held by the city, at $22,000. It also asks for a 50-year franchise, offering to give the city a percentage of the earnings after the first 20 years.

Personal.

MR. E. PINSON has been appointed director-general of the Compania Hidroelectrica e Irrigadora del Chapala, with headquarters at Guadalajara, Mexico.

MR. M. A. GURNEY, formerly representative of the Tungstolier Company in Iowa and Nebraska, has recently been appointed manager of the Chicago office of that company.

MR. O. S. MOORE, formerly a designer for the Western Electric Company, has been appointed chief engineer of the Fairbanks-Morse Electrical Manufacturing Company, Indianapolis, Ind.

MR. OSCAR C. TURNER has resigned from his position with the Warren Electric & Specialty Company to take the presidency of a jobbing company which is being formed in Birmingham, Ala., and which will commence business on Jan. 1, 1910.

MR. D. M. BLISS, formerly chief engineer for the Holtzer-Cabot Electric Company, Boston, and now with the Engineering Specialty Company, Stamford, Conn., has been appointed consulting engineer on the staff of the Edison Works, Orange, N. J.

PROF. B. F. BAILEY has returned to the department of electrical engineering at the University of Michigan, after serving for some time as chief engineer of the Fairbanks-Morse Electrical Manufacturing Company.

MR. SOLOMON A. SMITH was elected a director of the North Shore Electric Company, of Chicago, at the annual meeting on Nov. 29, to succeed Mr. Charles F. Spalding, deceased. Mr. Smith is second vice-president of the Northern Trust Company, of which his father, Mr. Byron L. Smith, is president.

MR. J. H. BRINKEROFF, long superintendent of the Rio Grande Junction Railway, Colorado, owned jointly by the Midland and Rio Grande railroads, has resigned to become assistant general manager and have charge of construction and operation of Grand Junction and Grand Valley electric interurban system.

MR. PERRY O. CRAWFORD, who until the date of its completion on Aug. 20, had charge of the design and installation of the Northern California Power Company's new south power house at Manton, Cal., has taken charge of the installation of the Inskip power house for the same company, with headquarters at Paynescreek, Cal.

MR. FRANK W. FRUEAUFF, president of the N. E. L. A., was married in Denver on the evening of Nov. 30 to Miss Antoinette Perry, of that city. Mr. and Mrs. Frueauff are at present on their honeymoon and will return to Denver again by the end of the present month. Among the numerous wedding gifts was a handsome Tiffany coffee set suitably engraved from the executive committee and staff of the N. E. L. A.

PROF. G. S. MACOMBER, of the Department of Electrical Engineering, Cornell University, gave an illustrated address on "Some Applications of the Cathode Ray Oscillograph" before the Ithaca A. I. E. E. Section on Dec. 3. The apparatus used to illustrate the lecture was that developed by Prof. H. J. Ryan some years ago, and upon which he made his famous determinations of the atmospheric losses on high-tension transmission lines.

MR. W. W. FREEMAN, second vice-president and general manager of the Brooklyn Edison Company, will return on Friday from an extended trip in the West. This trip was largely necessitated on account of important business matters of the N. E. L. A., of which Mr. Freeman is vice-president, and during the trip Chicago, Denver, St. Louis, Cincinnati and Pittsburgh were visited. While in Denver Mr. and Mrs. Freeman attended the wedding of Mr. and Mrs. F. W. Frueauff.

MESSRS. H. P. GIBBS, B. DWARKANATH and G. P. NARSIMIENGAR, of India, are visiting this country for the purpose of studying electrical developments. Mr. Gibbs is an American, but has been located in Bangalore for the past eight years and is now chief electrical engineer of the State of Mysore. He is a full member of the American Institute of Electrical Engineers. Messrs. Dwarkanath and Narsimiengar, who are native Hindoos, are superintendents of electric stations in the Bangalore.

MR. GEORGE H. GALL, general passenger agent of the Washington, Baltimore & Annapolis Electric Railway Company, has tendered his resignation. Mr. Gall will act as the special representative at Washington of a number of railroads and interstate electric railways. Mr. Gall became connected with the Baltimore, Annapolis & Washington Electric Railway soon after the opening of the latter line about two years ago in the capacity of publicity manager. He was soon promoted to the position of general passenger agent and given full charge of passenger traffic, still retaining his duties pertaining to general publicity. Prior to his railroad experience Mr. Gall was a Washington newspaper man.

MR. PAUL M. CHAMBERLAIN has opened an engineering office in the Marquette Building, Chicago. Mr. Chamberlain was graduated from the Michigan Agricultural College in 1888 and from Cornell University in 1890. For several years he was in practical work with the Brown Hoist Company, of Cleveland, Ohio; the Frick Company, engineers, of Waynesboro, Pa.; the Hercules Iron Works, of Aurora, Ill., and then accepted the assistant professorship of mechanical engineering at the Michigan Agricultural College. At the opening of the Lewis Institute in Chicago, he took charge of the engineering work there and coincidently carried on much consulting work with special reference to power production and factory methods. He resigned this position to act as chief engineer for the McCann Mechanical Works, of Los Angeles, Cal. Later he accepted the position as chief engineer of the Under-Feed Stoker Company of America, where for the past two years and a half he has made a special study of

boiler room equipment, economy in fuel burning and smoke abatement. Mr. Chamberlain will devote his time to new designs and improvement of existing installations.

MR. EDWIN E. WITHERBY has severed his connection with the Susquehanna Railway, Light & Power Company and with the Railways Equipment Company, Ltd., of New York, with both of which companies Mr. Witherby has been long affiliated. Although Mr. Witherby's resignation became effective on Dec. 1, he will not actually sever his relationships until the first of the year. When the Union Gas & Electric Company, which was chiefly created by the efforts of Mr. Witherby, was merged with the United Gas & Electric Company, the latter was the holding company up to the formation of the Susquehanna Railway, Light & Power Company in 1906, which took over the operation of the properties of the United Gas & Electric Company. Mr. Witherby was chief engineer and assistant to the president of the Susquehanna organization and was vice-president of the Railways Equipment Company. As general manager of the United Gas & Electric Company, much of the present importance of the electric light companies at Colorado Springs, Col., Elmira, N. Y., Lockport, N. Y., Leavenworth, Kan., Richmond, Ind., and Lancaster, Pa., embraced in this organization, may be traced to his managerial abilities.

Obituary.

MR. L. L. C. BROOKS, of St. Paul, Minn., secretary and treasurer of the Tri-State Telephone & Telegraph Company, died on Nov. 29, of pneumonia, after a short illness. Mr. Brooks was a conspicuous figure in the Independent telephone field in the Northwest, and his death will be sincerely regretted. He was a quiet man, but his associates recognized his judgment as sound, and his opinions carried weight.

MR. J. K. WARNER DAVENPORT, electrical engineer for the Croker Williams Manufacturing Company, Pittsburgh, died suddenly following an operation on Nov. 27. Mr. Davenport was born 32 years ago at South Hadley Falls, Mass. He attended Cornell University and was graduated with the class of 1900, being given the degree of M.E. with special reference to electrical engineering. He leaves a widow and two children.

MR. A. E. DRESSER, manager of the Syracuse office of the Fort Wayne Electric Works, died on Sunday, Nov. 28, of heart disease, and was buried at Ithaca, Nov. 30. He was 46 years of age and had been in the employ of the Fort Wayne Electric Works as manager of their Syracuse office for 10 years, prior to which he was with the Fort Wayne Electric Corporation and formerly connected with the General Electric and Thomson-Houston companies. Mr. Dresser had a wide circle of friends in the electrical trade in central and western New York State, where he always resided.

Trade Publications.

COAL CUTTERS.—Much information relating to electric coal-cutting machines is given in bulletin No. 18, issued by the Jeffrey Manufacturing Company, Columbus, Ohio.

ELECTRICAL SUPPLIES.—The Central Electric Company, 264 Fifth Avenue, Chicago, Ill., has issued a 64-page price-list and discount-sheet applying to its general catalog No. 26.

STREET LIGHTING SUPPLIES, for incandescent lamps, including spring-suspended sockets, heads and brackets, are illustrated in a folder issued by the George Cutter Company, South Bend, Ind.

COPPER-CLAD WIRE.—The Duplex Metals Company, 149 Broadway, New York, has issued an illustrated folder showing the advantages arising from using a copper-clad trolley wire in combination with a feeder wire rather than a large copper trolley wire.

STEAM REGENERATORS.—The Rateau Steam Regenerator Company, 2 Rector Street, New York, has issued a well-prepared bulletin dealing in an instructive manner with low-pressure steam regenerators, steam turbines and direct-current turbo-generators.

HIGH-VOLTAGE DIRECT-CURRENT RAILWAY.—Bulletin No. 4673, issued by the General Electric Company, describes the Pittsburgh, Harmony, Butler & New Castle 1200-volt, direct-current railway. The bulletin contains numerous illustrations and gives a more or less detailed description of the road, its equipment and operation, and should be of interest to railway men.

MOTOR-GENERATOR SETS are important factors in the distribution of electrical energy. The functions of the motor-generator set and the methods of choosing the motor-generator best adapted for each condition have been clearly outlined in bulletin No. 116, published by the Crocker-Wheeler Company, of Ampere, N. J. There is also a considerable amount of interesting engineering information in this bulletin.

Business Notes.

MOORE ELECTRICAL COMPANY, of Newark, N. J., reports a brisk demand for the Moore light. Among recent customers for color matching in dye house and examining departments are: Botany Worsted Mills, Gera Mills, Forstman & Huffmann Company, and Garfield Worsted Mills, all of Passaic, N. J.

ELECTRIC COOKING.—The Central Electric Company, Chicago, Ill., has issued a folder descriptive of a combined electric stove and toaster of a new type. This is a universal device provided with a toasting drawer and a heating plate, so that one can prepare coffee and toast at the same time.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 30, 1909.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

941,362. SYSTEM OF ELECTRICAL DISTRIBUTION; R. J. Dearborn, Wilkinsburg, Pa. App. filed Dec. 3, 1906. An alternating-current supply circuit, a current rectifier (rotary converter), a storage battery and transformer regulator connected to the circuit between the source of supply and the variable load so that the capacity of the former may be materially reduced.

941,363. TROLLEY CATCHER; C. I. Earll, New York, N. Y. App. filed Sept. 30, 1903. Automatically pulls down the trolley rope when the wheel leaves the wire. Improvements in a spring drum to which the rope is attached.

941,366. PRIMARY BATTERY; C. E. Hite, Burlington, N. J. App. filed April 15, 1907. A liquid tight battery with hand rubber lining and vertical partitions with a hard rubber rod supporting the electrodes.

941,372. SYSTEM OF ELECTRICAL DISTRIBUTION; P. M. Lincoln, Pittsburg, Pa. App. filed Dec. 3, 1906. A rotary converter, a storage battery and a booster generator between the main circuit and the rotary converter.

941,388. CROSS CONNECTIONS FOR DYNAMO ELECTRIC MACHINES; R. Siegfried, Pittsburg, Pa. App. filed Oct. 3, 1905. Uses a solid conducting ring segment which can be radially adjusted on one of the brush holder brackets by circumferential slots receiving bolts.

941,390. UNDERRUNNING CURRENT COLLECTOR; S. B. Stewart, Jr., Schenectady, N. Y. App. filed Nov. 23, 1904. A stand on the car roof carries a set of planeographic levers which support a shoe.

941,391. ELECTRIC CAR CONTROLLING SYSTEM; A. B. Stiszer, Philadelphia, Pa. App. filed Aug. 2, 1909. Enables two cars, which may be operated as units, to be coupled and operated from a single controller. Uses a circuit coupling which connects with the motors independently of the controller or to connect the controller, the coupling and the motors in parallel.

941,397. MOTOR CONTROL SYSTEM; H. E. White, Schenectady, N. Y. App. filed June 23, 1909. A plurality of switches to increase the voltage for starting the motor, step by step. The switches are operated by solenoids, the actuating coil of the first being in shunt to the motor.

941,408. CONTROL OF ELECTRICALLY OPERATED SWITCHES; A. S. Cubitt, Schenectady, N. Y. App. filed May 7, 1908. For successively operating a plurality of switches.

941,412. MOTOR STARTER; M. R. Hanna, Schenectady, N. Y. App. filed Sept. 12, 1907. Automatic starter in which a number of electromagnetic switches short circuit sections of resistance in series with the motor or armature.

941,416. PRIMARY ELECTRIC CELL OR BATTERY; A. Heil, Frankfort-on-the-Main, Germany. App. filed April 6, 1909. Uses a depolarizer consisting of sulfate of mercury, finely divided carbon and free mercuric oxide.

941,418. SLIP INDICATOR; G. A. Johnstone, Revere, Mass. App. filed April 30, 1908. For an induction motor to determine its slip visually by combining with a source of light which varies in intensity in synchronism with an alternating current circuit of means for exposing the source of light at intervals varying in frequency with the speed of an induction motor connected to the circuit.

941,419. ELECTRIC FURNACE; C. A. Keller, Paris, France: App. filed Nov. 4, 1908. A hearth serving as an electrode and comprising a metal plate, a plurality of metallic elements connected therewith and projecting therefrom, a refractory body in the spaces between the elements and surrounding the same and a second refractory body enclosing the first body.

941,425. ELECTRIC CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed April 6, 1906. A motor starting rheostat having a circuit breaker with means for automatically inserting the resistance of the rheostat independently of the circuit breaker and means for automatically opening the breaker if the starting resistance is left in circuit too long.

941,435. INDUCTION FURNACE; M. Unger, Pittsfield, Mass. App. filed May 6, 1908. In which the furnace chamber is placed in inductive relation to the primary of the transformer, the charge serving as a secondary. The furnace consists of a plurality of magnet cores, winding thereon and an annular furnace chamber surrounding the cores communicating with a central chamber.

941,436. ELECTRIC METER; F. M. Vogel, Lynn, Mass. App. filed Sept. 14, 1904. A watt meter for alternating-current in which the rotatable member is acted upon by two magnetic circuits, each completely surrounded by shunt and series windings which act in conjunction on one circuit and in opposition on the other. The torque is produced by the induced currents.

941,439. MOTOR GENERATOR SET; W. A. Danielson, Des Moines, Iowa. App. filed Aug. 18, 1908. A motor generator set operating on a constant potential circuit to supply constant current and in circuit where the resistance varies. The generator has a set of brushes short circuiting the armature 90 deg. from the line of field magnetization and a second set of brushes displaced 90 deg. from the first.

941,441. RHEOSTAT; G. H. Dorgeloh, Schenectady, N. Y. App. filed June 10, 1908. Provides with a starting resistance an unbiased controlling arm interlocked with an automatic circuit breaker which cannot be closed until the arm is moved to starting position. Uses an underload coil.

941,445. ALUMINUM CELL REACTANCE; J. J. Frank, Pittsfield, Mass. App. filed Feb. 2, 1909. A plurality of aluminum condenser cells in series and a plurality of transformers, each having one winding connected across one of the cells and another winding in multiple with a winding of each of the other transformers.

941,456. DYNAMO ELECTRIC MACHINE; F. B. Howell, Schenectady, N. Y. App. filed Aug. 30, 1907. For supporting the fields in which a field coil surrounds a pole provided with a tip, and the coil support has a raised portion fitting over a part of the pole and a flanged portion holding the coil against the pole tip.

941,459. ELECTRIC METER; P. C. Morganthaler, Fort Wayne, Ind. App. filed May 22, 1909. An alternating-current meter having a U-shaped core with double poles, a potential coil carried thereby, a series coil surrounding the inner poles and lagging coils surrounding the outer poles.

941,534. ELECTRIC SWITCH HANDLE; J. G. Peterson, Hartford, Conn. App. filed June 15, 1909. For rotary snap switches in which the handle is made of porcelain and has a socket extending partly through the handle, a yoke in the socket and a headed stem extending through the yoke, with a spring between the stem and the yoke.

941,535. ELECTROPLATING APPARATUS; L. Potthoff, Flushing, N. Y. App. filed Feb. 2, 1909. A horizontally inclined rotary drum with a screw conveyor inside in which the articles are carried.

941,541. CAB-SIGNAL CIRCUIT; Paul J. Simmen, Los Angeles, Cal. App. filed June 19, 1908. A signal on the vehicle, means in the track wave for setting the signal at danger, an alarm on the vehicle, means for actuating the alarm when the signal is at danger and for rendering it inoperative when the vehicle is not in motion.

941,553. PROCESS OF PRODUCING LOW CARBON, LOW-SILICON TITANIUM ALLOY; F. M. Becket, Niagara Falls, N. Y. App. filed June 12, 1907. The process of producing a low silicon titanium alloy which consists in producing a high silicon alloy and oxidizing the contained silicon.

941,576. ILLUMINATING DEVICE FOR KEYHOLES; J. D. Hardin and J. B. De Saussure, Chattanooga, Tenn. App. filed Oct. 2, 1908. For making the keyholes visible at night in which the door knob has a light transmitting portion and which is movable in the direction of the length of the knob spindle, the knob being hollow so as to contain an electric light which is controlled by the longitudinal movement of the knob.

941,593. INCANDESCENT LAMP; R. D. Tiffany, Bellingham, Wash. App. filed Aug. 27, 1908. The lamp has a multiplicity of filaments and a rotating element driven by a gear from the outside so as to throw any one of them into circuit.

941,599. MEANS FOR RECTIFYING SINGLE PHASE CURRENTS; J. L. Woodbridge, Philadelphia, Pa. App. filed May 4, 1908. An armature surrounded by a squirrel cage, the armature supplied with alternating current and having two sets of electrically displaced brushes, each set interconnected in a circuit with means for producing relative rotation of armature brushes in synchronism with the alternating current.

941,600. SYSTEM FOR ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed April 14, 1909. An electric converter producing a constant direct-current voltage across one set of brushes and a variable direct-current voltage across another set, connected to a regulating storage battery.

941,601. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed April 14, 1909. An electric circuit, a storage battery and a booster with means responsive to the charge and discharge of the battery adapted to excite the booster to oppose the charge and discharge.

941,660. ELECTRIC SWITCH; F. W. Smith, New York, N. Y. App. filed Feb. 25, 1909. An electric switch with a pivoted circuit closing switch arm, a fixed guide bar, a link pivoted to the arm and bearing on the bar with means for moving the link along the bar, said means being an electromagnet.

941,673. ELECTROVIBRATORY COUCH; W. A. Church, Los Angeles, Cal. App. filed Dec. 21, 1909. For exercising the muscles and imitating horseback riding. The couch is vibrated by a motor and crank.

941,690. ELECTRICAL SYSTEM OF DISTRIBUTION; W. E. Winship, New York, N. Y. App. filed March 11, 1905. The combination of alternating and direct-current circuits with a converter between them, a battery connected to the direct-current circuit which charges and discharges according to variations of load on either circuit.

941,709. RELAY; T. W. Gleeson, Boston, Mass. App. filed Jan. 29, 1908. Electromagnetic relays for telegraphs in which a magnetically inductive armature has pole pieces and a permanent magnet has one of its poles next to the armature and the other pole separated therefrom with a soft iron member between the magnet and the distant pole.

941,761. RELAY; E. R. Corwin and C. A. Bals, Chicago, Ill. App. filed Sept. 21, 1908. Relays for telephone indicators in which coil may be removed without dismounting the relay. Details.

941,763. BANK OF LOCKING SWITCH KEYS; E. R. Corwin and C. A. Bals, Chicago., Ill. App. filed Jan. 29, 1909. Banks of locking keys of the push-button type arranged over a distributing strip having terminals with a removable casing.

941,768. ELECTRIC FURNACE FOR GAS REACTIONS; O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany. App. filed Aug. 25, 1908. For producing gas reactions, including two electrodes in the furnace, one consisting of fragmentary carbon and made hollow so as to supply the gas there through.

941,777. MEANS FOR CONTROLLING ELECTRIC CIRCUITS; G. W. Hart, West Hartford, Conn. App. filed April 5, 1909. A door lock using two three-point switches with a solenoid for operating, one of them having its winding controlled by a circuit-closer closed by lock on the door.

941,808. CORD TERMINALS; F. Parsons, Boston, Mass. App. filed April 9, 1909. Connecting clip for automobile spark plugs, having a flat body of spring metal specially constructed to surround the head of the plug.

941,810. METHOD OF MAKING INSULATING-COVERINGS FOR ELECTRIC CONDUCTORS; W. A. Phillips and F. Hutchins, London, Eng. App. filed June 8, 1908. Mixes gilsonite and castor oil, heats, cools and mixes with a hydro-carbon.

941,811. KEYLESS SOCKET; C. D. Platt, Bridgeport, Conn. App. filed Oct. 22, 1908. The block may be molded by one compression and the parts secured together by a simple rivet.

941,826. THERMO ELECTRIC GENERATION; J. D. Taylor, Pittsburg, Pa. App. filed May 27, 1907. Thermo couples on a rotary carrier with heating and cooling compartments surrounding the carrier and other heating and cooling compartments arranged interiorally of the carrier.

941,859. TERMINAL FOR ELECTRIC CABLES; C. W. Davis, Edgeworth, Pa. App. filed Aug. 3, 1908. Consists of a sleeve with its lower end equal to the diameter of the sheath of a cable and its upper portion spread out to permit the separation of the conducting cores. The head is closed by a cap.

941,860. TERMINAL FOR ELECTRICAL CABLES; C. W. Davis, Edgeworth, Pa. App. filed March 6, 1909. For a multiple conductor cable, including a casing, an insulator which is perforated larger at one end than at the other, a portion of the surface of the perforation being rough and arranged obliquely to the axis thereof.

941,893. BINDING POST; I. Steinberger, New York, N. Y. App. filed April 2, 1909. A stem with clamping plates encircling the same and means for preventing the easy removal of the clamping plates from the stem and a spring for pressing the clamping plates apart.

941,904. PROCESS FOR TREATING CERTAIN ORES; H. S. Auerbach, New York, N. Y. App. filed Sep. 6, 1906. Reduces galena by forming a body of fused lead, on top of which is a fuse electrolyte, to which body the ore is added, the ore being soluble therein and direct contact between the ore and the electrolyte being prevented. An electric current is then passed through the charge.

941,938. TELPHERAGE SYSTEM; H. Muller, Leipzig, Germany. App. filed Feb. 7, 1906. Reduces the number of conductors and separates the regulating of the electric current taking from the regulating of the mechanical operations. The mechanical movements are regulated by a magnet current closer in the carriage actuated by impulses given at the starter.

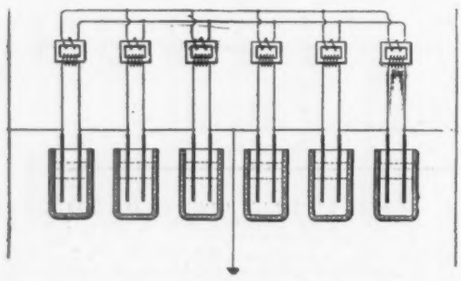
941,941. SWITCH FOR INCANDESCENT LAMP SOCKETS; W. A. McDonald, Grampian, Pa. App. filed Feb. 26, 1909. A switch for incandescent lamp sockets comprising a frame having a stationary handle and two movable handles with means for completing the circuit by forcing one of the movable handles toward the stationary handles.

941,944. TROLLEY RETRIEVER; C. Palm, Aurora, Ill. App. filed Sept. 22, 1908. The trolley is lowered to the roof of the car by a spring-driven drum.

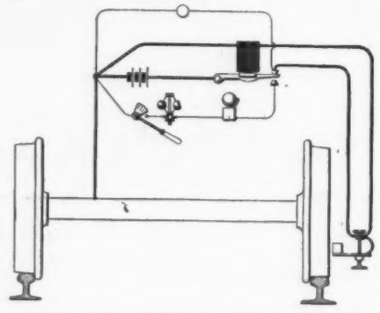
941,979. ATTACHMENT FOR ELECTRIC APPLIANCES; H. W. Denhard, San Francisco, Cal. App. filed Aug. 7, 1908. Takes the strain from terminal conductors by means of a ring or eyelet secured to a twin conductor and a retaining band in the rear of the ring.

942,002. WALL CABINET FOR ELECTRICAL APPARATUS; E. R. Le Manquiais, Bellemead, N. J. App. filed May 11, 1907. A container having its side members made into two separable parts recessed along the line of separation to receive bushings which form insulating supports for a cable passing through them.

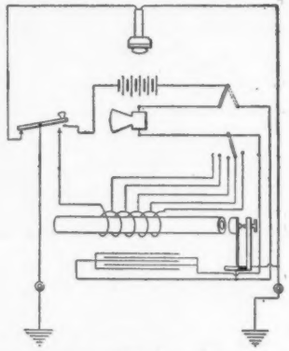
942,044. WIRELESS TELEPHONY AND TELEGRAPHY; A. W. Sharman, Clapham, London, Eng. App. filed July 16, 1909. For telegraphing through the earth by joining the poles of a low tension current and the two ends of a self induction coil each to earth to a plurality of pairs of contacts. Adjusts resistance of the coil to the rest of the circuit, suddenly reduces the low tension current and when it is at a minimum impresses a maximum voltage from the induced direct current through the coil, on the earth contacts.



941,445—Aluminum Cell Reactance.



941,541—Cab Signal Circuit.



942,044—Wireless Telephony and Telegraphy.